

NEWS IN PERSPECTIVE

ECONOMIC CLIMATE

UNCERTAINTY SEEMS A VIRTUE at this point in the economic cycle when most signs are favorable, but a fair amount of informed opinion confesses to mild pessimism. In this situation, stability is likely to be the gainer. Excesses of over-optimism and retrenchments of pessimism are likely to be avoided, leaving the basic forces of moderate expansion in a position to make themselves felt.

ON THE OPTIMISTIC SIDE, for the balance of this year and on into 1961, is the preponderance of factors that make for economic growth. Credit seems to be easing, and construction will be the gainer. Steel inventories are being used up more rapidly than they are being replaced; an upturn in production is likely. Spending for new plant and equipment is being directed, in large part, toward improvement and modernization, not as much to the construction of brand new productive capacity. Government spending at all levels is rising. Also on the upswing are exports, personal income and private investment.

MANAGEMENT VIEW

WHY NOT UNDERGROUND?--A simple, convincing little booklet, distributed to customers by Cleveland Elect. Illuminating Co., asks . . . and CEI answers, says the reason is mostly the added cost (which could mean doubling of present electric bills), plus a number of other drawbacks. (CEI notes that 9 out of 10 customers surveyed say "no", if the extra cost must be incurred.)

WHO PAYS FOR "PUBLIC POWER" is another subject CEI has approached effectively with a question-answer booklet. Referring to the booklet's aim, CEI's Chairman Lindseth notes: "Until they have the facts, American tax-payers

can't reasonably be expected to protest further growth of government-in-the-electric-business--and the tax drains and inequities it creates". Far from being "ineffective exhortation"--as some have critically called recent public expressions by utility company spokesmen--the facts-to-judge presentation used by CEI can and does produce "favorable" response.

PP&L MAKES BOOKLETS WORK, TOO. The Allentown, Pa. utility uses a series of pocket-size booklets to make sure that employees will be better equipped to meet customer inquiries directly. Rates, regulation, area development, "a business portrait of PP&L"--each informative and enlightening discussion helps materially in showing up the employee's own particular pitch for his organization.

EMPLOYEE CONTACT TRAINING is constantly needed in utility companies, a study of such training programs by the Wisconsin Utilities Association concludes. Among eight Wisconsin utilities, observation by and discussion with his supervisor is "most popular" of all methods for training the employee, with group meetings and movies also widely used.

COLLECTION ACTIVITY TRENDS, also checked in a survey by the WUA, include (a) declining use of the reminder notice; and (b) an increase in numbers of "cut-offs" for non-payment and in reconnections after cut-offs.

WOMEN IN MANAGEMENT of utility companies? There are many, and they occupy many different key spots--from the popular home service and lighting directorships to V-P responsibilities, with advertising, personnel and finance fairly frequent duties. That's what Middle West Service Co. found in a recent survey--see page 34.

NEWS IN PERSPECTIVE

RESEARCH ADAPTING ELECTRICITY to new uses will provide the average family more conveniences in the next decade than were invented in the past half-century, predicts Pacific Power & Light Co.'s Pres. Don R. McClung. In noting that Portland, Ore. based utility's 50th anniversary, he compared the 1910 cost to the consumer of 15 to 20-cents/kwh with the present cost of a little more than one cent/kwh.

"CURRENTLY SOMEWHAT CAUTIOUS about authorizing new projects, utility managements will probably not continue this frame of mind for long . . . in view of the industry's prospects," comments Pres. George C. Walker in his recent annual meeting report for Electric Bond and Share Co.

WASHINGTON INFLUENCE

"SIDE-DOOR VICTORY has been handed to the government power forces who fought unsuccessfully in Congress against the program to foster private atomic power development . . ." says EL&P's Ralph Elliott about the Appellate Court decision on the PRDC (Enrico Fermi plant) permit case. (See page 38.) Observes Columnist Elliott about the ruling (on which both the PRDC and AEC quickly filed petitions for rehearing): "Under the decision's sweeping mandates, it is highly doubtful that anyone-- other than the federal government-- would be in a position to pioneer in the development of commercial size power reactors."

NEWEST ADVICE TO REAS, offered by the Administration in new bulletins covers finance and customer service. "How to Make and Use Financial Forecasts" stresses the need for long-range planning, urges the use of funds in excess of two years debt service to buy new equipment or to make advance payments on loans. And, an REA bulletin warns: Servicing remote customers should be approached judiciously if it involves investment in many types of equipment. "Many customers (might) prefer a period of somewhat inadequate service to a rate increase resulting from a large investment in facilities," the bulletin says.

REPUBLICAN ACCOMPLISHMENTS in water resource development have been totted up by Interior Secretary Seaton. The Administration's over-all record "has resulted in one of the brightest eras in the history of reclamation in the West," says Seaton. He cites Congressional authorization of 52 reclamation projects or project units since 1953--a storage increase of about 50-percent--with their hydro powerplants each year delivering about 8.5 billion kwh--a production increase of about one-third (excluding the fiscal 1961 Reclamation budget request). Seaton added: "The record is clear that the Eisenhower-Nixon Administration has met the twin tests of action and results" despite record peace-time defense costs and the fact that in every fiscal year except one, Congress did not fill the President's requests.

VP NIXON ON "GROWTHMANSHIP"--"It is foolish to assume, as some of those from the growthmanship school seem to, that government activity is in itself good. But it is just as wrong to assume that government activity is in itself bad."

PREJUDICE AGAINST REA CO-OPS within the Interior Department is claimed in an interim report of a House Committee on the Yellowstone Park electric contract. It asserts that Montana Power Co.'s proposal exceeded one co-op's proposal by over \$30,000 a year and says that preliminary studies, adjusted to present-day living costs, may make the difference run as high as \$70,000 a year in favor of the Fall River co-op. (Because of erroneous calculations, Interior is at present restudying the matter to see if it should revise or cancel its contract with Montana Power.) Rep. Moss (D., Calif.), in answer to minority views filed by Rep. Hoffman (R., Mich.), claims that "it is clear that where a choice existed, an unmistakable preference for dealing with a private company rather than with a cooperative was expressed in writing and was demonstrated by the Department's actions."

AMENDED AMISTAD DAM BILL passed by the Senate, will be returned to the House because of disagreement over

whether power facilities at the proposed Rio Grande Project will pay for themselves. Majority Leader Johnson (D., Tex.) warmly recommended passage not only for flood control and foreign relations reasons but also because Congress "rarely sees a project with this high a benefit-to-cost ratio." Sen. Hickenlooper (R., Iowa), before voting, drew attention to concern over whether the cost of the power plant would be self-liquidating.

BPA-CALIFORNIA INTERTIE decision will be delayed until all studies now in progress are completed.

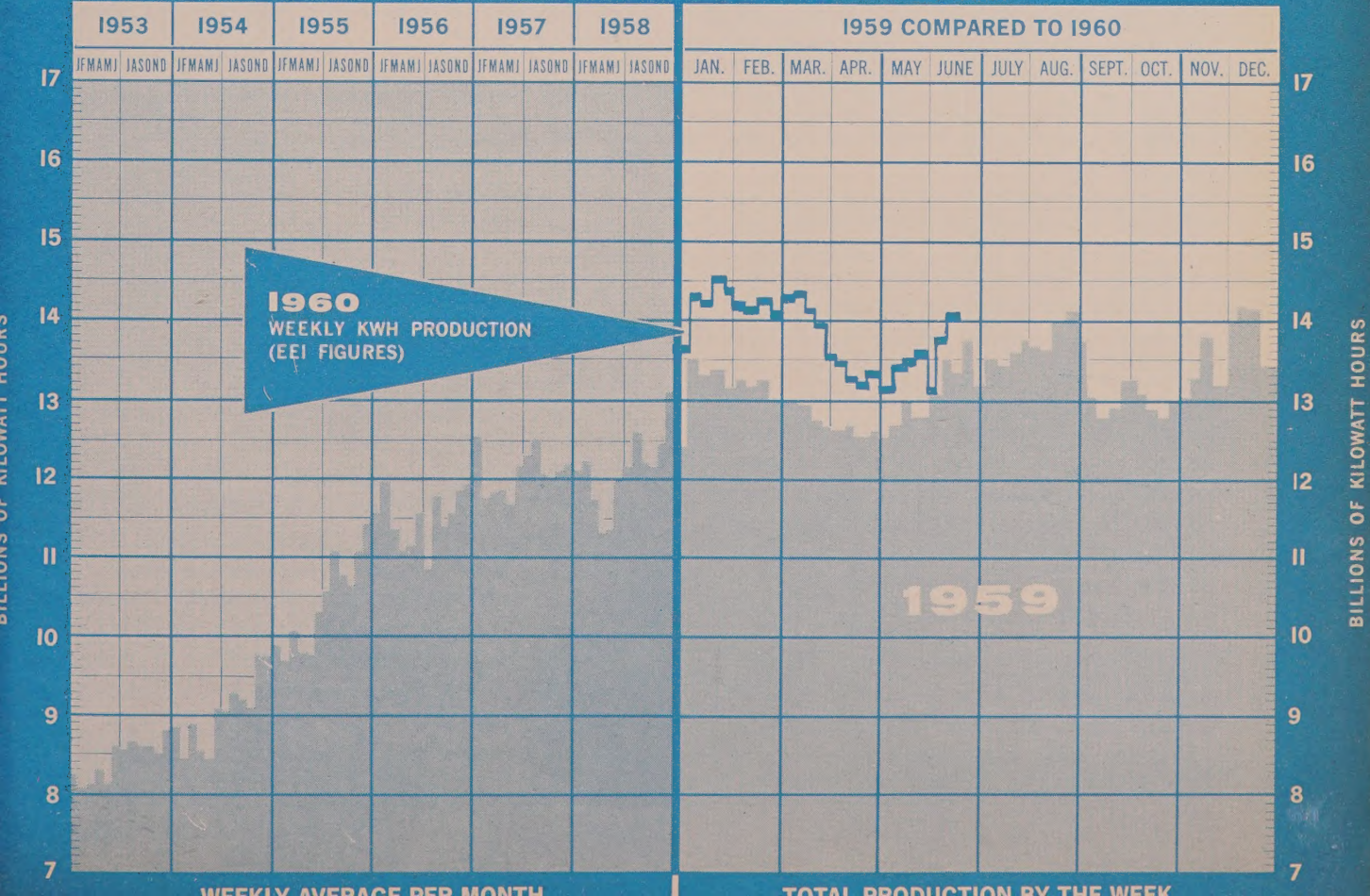
MOBILIZING ELECTRIC POWER in a national emergency has been outlined by the Office of Civil and Defense Mobilization. Sixteen "defense electric power areas" are established, keyed to existing power pools and interconnected systems, under Area Power Directors.

ELECTRIC HEATING SURVEYS show (a) homeowners want it, overwhelmingly (80-percent of 360 persons questioned); (b) one group important in the financing of it--the savings and loan associations --has a good knowledge of and appreciates certain advantages of electric heat. Corning Glass Works made one survey, found "low-upkeep" most frequently listed among the advantages of electric heat; the U. S. Savings & Loan League checked its member associations in another, found "(relatively) low installation cost," and "greater comfort, convenience and effectiveness" rated high among the advantages. Both surveys indicated "high cost" remains the No. 1 disadvantage.

LARGEST STEAM-GAS TURBINE combined cycle station in the world will be Oklahoma G. & E. Co.'s in 1963, when more than 200-megawatts of new capacity become available in a Sargent & Lundy addition (General Electric equipment).

Electric Utility Barometer

(Source: Edison Electric Institute)



BOILING-WATER A-PLANT, demonstrating an improved design, 50,000-kwe prototype of a proposed 300-megawatt reactor, is to be operated for the AEC by the cities of Los Angeles and Pasadena, Cal. GE will furnish the reactor, with the plant to be completed in mid-1963.

COMMONWEALTH EDISON, HONORED by the EEI last month with the Edison Award for its Dresden nuclear power project, collected another later in the month when the Chicago Association of Commerce & Industry saluted CE, Argonne National Laboratory and the U. of Chicago's Argonne Cancer Hospital for outstanding contributions in the development of peaceful uses for atomic energy. Event was Association's International Trade Fair, and occasion was the fair's "World Peace Day."

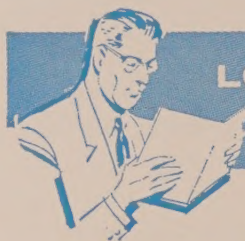
TRANSFORMER RATINGS have been increased by Kuhlman Elect. Co. and by Wagner Elect. Corp.--by 12-percent--because improved insulation raises new rating from 55C to 65C. Kuhlman up-ratings apply to power and distribution units, Wagner's to pole-type dist. units.

TOSHIBA LIGHT BULBS--after comparisons with bulbs submitted by the national laboratories of the U.S., UK, USSR, Germany and France--has been selected by the International Bureau and Measures in Paris as the new world's standard for measuring the brilliance of electric light.

FREE RADICAL ENERGY CONVERSION directly to useful power is reported to be an accomplishment of the recently formed Energy Conversion Laboratories in Detroit. Though no plans have been made for commercializing the newly developed system for utilizing the energy of free radicals present in chemical reactions, the experiments say that experience from working model operation "suggests the possibility of adapting the phenomena to self-contained packaged power units capable of being started and operated continuously."

SAVE THE TREES!--The Dept. of Agriculture last month released its new 16-page booklet, "Look to Your Timber, America", hoping to acquaint all American people with the reasons why "a lot

more needs to be done in reducing fire losses and holding down insect and disease losses . . . if this country is to have the timber it needs 40 years from now." (Meanwhile, utilities joined other forces to intensify the fight against the great season threat: fires in the dry months of summer. Example: Sacramento Utility Dist. is bearing the cost of an extra 10-man patrol to supplement the normal complement in U. S. Forest Service personnel in California's Eldorado National Forest.)



LOOKING AHEAD... FINANCIALLY

--From Irving Trust

New money financing for 6 months totaled \$1,328,528,000 (66-percent electric), down 15-percent from similar period last year.

Volume in June of \$288,064,000 (57-percent electric) is second highest monthly total during 1960, without benefit of any electric preferred or common financing.

AAA-One issue sold in June. On the 10th, \$25,000,000 of Baltimore Gas & Electric yielding 4.75-percent (no refunding protection) was fairly well received.

AA-Three issues offered and all still in syndicate--\$50,000,000 of Consolidated Edison (refunding protection for 5 years) to yield 4.70. \$17,000,000 of Gulf States Utilities, \$25,000,000 of Tampa Electric at a yield of 4.84-percent.

A-Three issues sold, none with refunding protection--\$40,000,000 of Southern Electric Generating (yielding 5.20-percent), which met with a fair reception, \$12,000,000 of Washington Gas Light (yield 5.20 percent) and sold within 24 hours, and \$5,000,000 of Savannah Electric (yielding 4.95-percent).

BAA-Three offerings in June, including one by Savannah Electric. There was one preferred and two common stock offerings--all by gas utilities.

Prices on seasoned electric company bonds were higher generally. Prices on preferreds were up slightly in our three groups while prices on outstanding commons rose moderately.

Mounted horizontally, vertically or underslung, you'll find the new Westinghouse V-2 air break switch easiest and quickest to install and adjust . . . saves crew time. Westinghouse engineers considered all installation and alignment problems, then carefully designed them out of the V-2 while making its operation as effortless as possible. Here are some highlights of the new V-2 switch:

POSITIVE, ENCLOSED STOPS, easily adjusted during installation by accessible threaded studs, precisely regulate blade travel in any mounting position. Stops cannot malfunction even under icy conditions.

PROTECTED ADJUSTABLE SLIP JOINT in quick-access enclosure allows positive, simple, in-field positioning of blade in break jaw. Correct positioning eliminates blade motion and contact burning during fault conditions.

NEW SPLIT-TYPE ROD ENDS for interphase pipe provide easy preliminary adjustment, with piercing set screws to hold final settings.

LONG-TERM, LOW OPERATING EFFORT is assured by teflon-coated bushings on all live-side bearings. Bushings are almost frictionless, resist corrosion, never need lubrication. Mean long life, less maintenance.

In addition to these benefits, the new V-2 switch retains the unique mechanical advantages of the pioneering "V" design—such as the solid current-carrying bridging member enclosed at blade hinge, yet completely inspectable . . . universal operating lever on driven pole . . . rotating insulator bearing recessed in base . . . and the ability to operate positively and safely under adverse atmospheric conditions.

WANT MORE INFORMATION on the new Westinghouse V-2 switch? Contact your nearby Westinghouse sales engineer or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania.

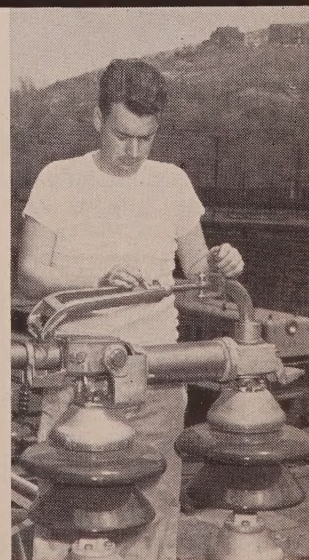
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YOU CAN BE SURE...IF IT'S Westinghouse



EASY PRELIMINARY ADJUSTMENT of interphase pipe is provided by new split-type rod ends. Piercing set screws hold final settings securely.

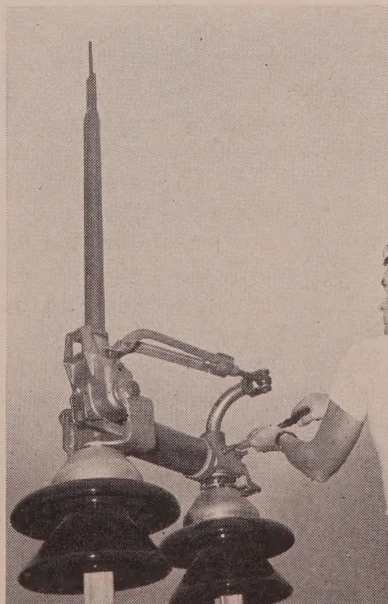
SIMPLE INSTALLATION, EASY OPERATION of the new Westinghouse V-2 switch are achieved because: (1) threaded studs adjust enclosed stops that control blade travel; (2) enclosed slip joint provides simple alignment of blade in break jaw; and (3) teflon-coated bushings on live-side bearings reduce operation friction.



CORRECT BLADE POSITIONING in the break jaw is possible with enclosed, easy-access adjustable slip joint. Adjusting nut positions blade for precise coordination with blade stop in break jaw to eliminate contact burning under fault conditions. Adjustment can be easily made in the field regardless of switch mounting position.



MAINTENANCE IS MINIMIZED in V-2 switch by non-corrosive, teflon-coated bushings. Uncoated bushing at left is badly corroded after 1000-hour salt spray test. Coated bushing (center) is unharmed. Bushing at right, even with outside teflon coating deliberately removed, is nearly perfect, protected by teflon which penetrated metal.



Middle West Survey Finds

Women Rank High In Utility Jobs

New evidence of the extent to which women are assuming key assignments in utility management comes from a survey just completed by the Middle West Service Company.

In its check of the practices of 217 electric, combination and gas utilities, Middle West found women officers and managers were almost equally distributed among all sizes of companies. These are the responsibilities being handled by women:

Three of the utilities reported a woman as vice-president of the utility, and four corporate secretaries and 28 assistant secretaries were listed. Three companies reported a woman as the corporate treasurer, and 12 utilities reported having women assistant treasurers.

Four companies reported women advertising directors, five reported women personnel managers. A woman holds the position of commercial manager in one reporting utility, and a woman district manager was reported by another. Home service and lighting directors were listed most frequently in the management classification by all types of utilities.

Other findings of the Middle West Survey included these statistics: 50 percent of 76 electric companies employ between 0.95 and 1.35 women per thousand customers; 25 percent of the companies employ more than 1.35 women per thousand customers, and 25 percent of the companies employ less than 0.95 women per thousand customers. Thus, 50 percent of the companies serving less than 50,000 customers employ between 5.45 and 7.55 employees per thousand customers. (It has been suggested that

the lack of need for male production workers in the smaller electric utilities is partly responsible for the lower employee per thousand customer value.)

It was discovered that the utility industry employs a greater proportion of younger women than the entire national labor force. In all utilities, it was found that 57 percent of the women employed were under age 35, compared with 39 percent below age 35 in the entire national work force.

The utility industry also employs a greater percentage of single women (50 percent) than are employed in the national labor force (25 percent). The larger utilities, which were found to employ a greater percentage of women under age 35, also employ a greater number of single women than the smaller utilities.

Fifty percent of the reporting companies serving under 200,000

WOMEN: How They Help Sell Street Lighting Modernization

Women are demonstrating their importance in a new field—street lighting.

Recognition for this role came to them last month from the "Reader's Digest," when along with several municipalities and electric utilities, a Federation of Women's Clubs received the publication's newly established Public Service Award for aiding street light modernization.

Campaigns to make their streets safe after dark have won "Reader's Digest" Public Service Awards for the Federation of Women's Clubs of Greater Cleveland, the City of Chicago, the City of Detroit and the Detroit Edison Company, and the City of Rockville, Conn., and the Connecticut Light and Power Co.

All were honored, according to their citations, for "street light modernization programs that have made their cities the nation's safest after dark." The Public Service Awards

credit the winners with setting an example for the remainder of the nation in providing for the nighttime safety of their citizens.

The awards were presented in conjunction with an article, "To Make Streets Safe After Dark," in the June issue of "Reader's Digest." Robert O'Brien, the author, points out that 73-percent of the nation's murders, assaults, rapes and muggings are committed at night.

In the months to come, more women's organizations can be expected to be involved in faster street light modernization, too. The "Reader's Digest" announced at the recent annual meeting of the General Federation of Women's Clubs in Washington, D. C., that it will award a first prize of \$500 and five

runner-up prizes of \$100 "to those local clubs in the Federation which initiate the best community programs in the next 12 months to improve street and highway lighting." Presentations will be made at the Federation's '61 annual meeting.



When Detroit Edison won a "Reader's Digest" lighting award, Pres. Walker Cisler (center) accepted it from Chas. Hepler. At left, Detroit's Mayor Miriani.

customers reported a median annual wage for women employees between \$3,300 and \$3,900. Fifty percent of the companies serving more than 200,000 customers reported women's median annual wages between \$3,300 and \$4,050.

Of course, women also figure prominently in the ownership of utility companies—to a greater extent than they do in the ownership of all investor-financed corporations. (A 1959 New York Exchange study reported that women comprised 37.5 percent of all stockholders on record in 1959.) Compared with this, the percentage of stockholders who are women, according to the Middle West survey is: in electric companies—44 percent; in combination companies—43 percent; in gas companies—40 percent.

**To Canadian Government:
Interconnect All Systems**

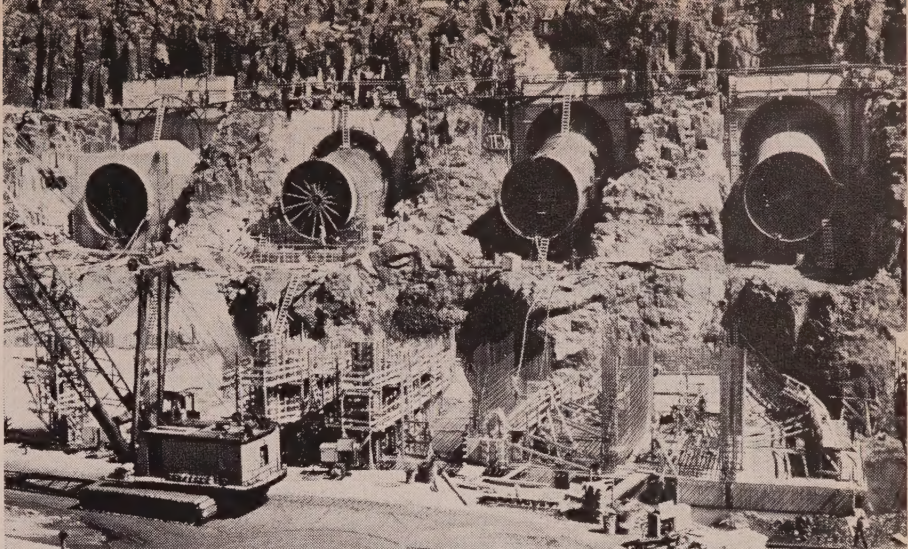
A major interconnection of all electrical systems from coast to coast in Canada was advocated in a recent presentation on "Hydro-Electric development in the Province of Saskatchewan" to the House of Commons Committee on Mines, Forests and Waters. The presentation was submitted at the federal government's invitation by David Cass-Beggs, general manager of the Saskatchewan Power Corporation.

Annual savings which could be made through the most economical use of all Canada's available energy resources would be more than adequate to meet the costs of a trans-Canada system, it was predicted.

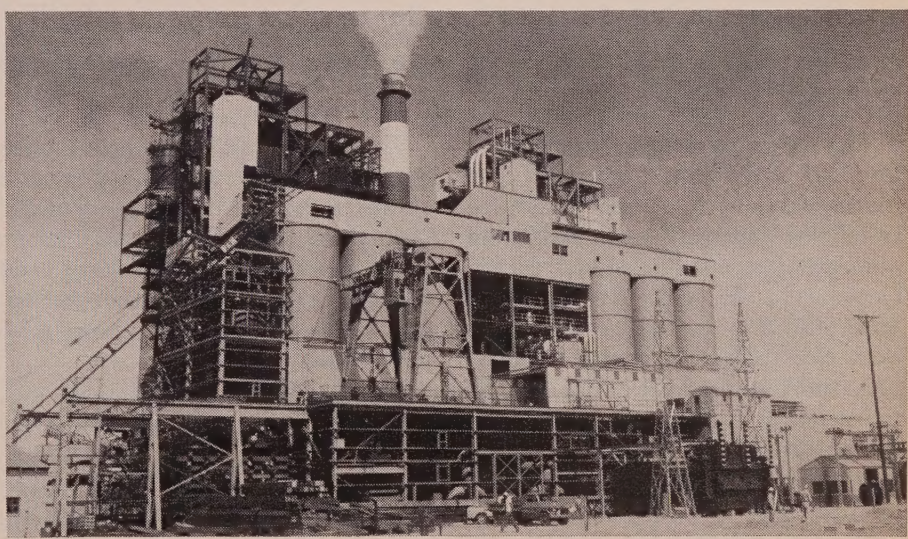
In addition to the recommendation in interprovincial interconnection, these goals were outlined:

Ultimate development of a total of approximately four-million horsepower in hydro capacity on the Saskatchewan River system, through construction of a series of dams which would convert the river into a series of lakes throughout its length in Saskatchewan.

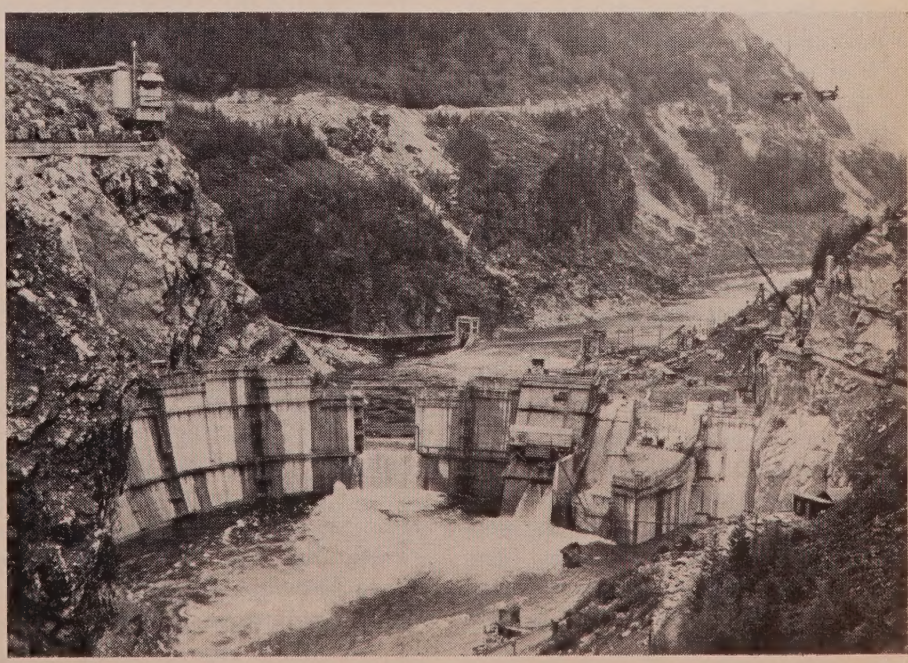
Possible development of "pumped hydro storage," which could increase hydro capacity by pumping water back upstream during low load periods and returning it down stream for additional generation during peak periods, in effect reversing the flow of the river.



Oxbow Dam powerhouse begins to rise from bedrock excavation at base of sheer rock, as penstocks loom overhead. Idaho Power Co. project will produce 200,000-kw of new hydro power in the West. (Another: Portland G. E.'s proposed 275,000-kw Round Butte project.)



New steam power must be supplied too, like this second 100,000-kw generating unit in Pacific P. & L. Co.'s Dave Johnston plant near Casper, Wyo.—to be operating in October. Below, Seattle City Light's High Gorge Dam is getting a new intake tunnel, the old one being plugged as water is diverted through dam openings. Capacity will be boosted by 50,000-kw with use of a higher head. (On the Pend Orielle River, Seattle Light proposes a new, "best undeveloped" project.)





Colorado Commission Hikes Rates Of Colorado Public Service Co.

Company receives electric rate increase of \$3,200,000.

Year-end Original Cost Rate Base used with no weight given to Fair Value.

Rate of Return fixed at 6.15% plus 0.2% for attrition in earnings.

Tax deferrals included in rate base for attrition purposes only.

Account 100.5 excluded from rate base but allowed as an expense.

This in some respects is a most unusual rate case, particularly as to the treatment of the restricted surpluses arising from accelerated amortization and liberalized depreciation. In determining the rate base, the Commission deducted both the restricted surpluses arising from Sections 167 and 168 on the grounds that any repayment of the deferral is so far in the future as to constitute a permanent reduction in taxes. Noting that the composite depreciable life of the property is forty years, the Commission states that:

"It is obvious, therefore, that an increase in taxes actually paid by the Company over normal straight line methods of depreciation will be deferred for a substantial period of time. Thus, the oft-expressed fear that the adoption of the flow through method would compel an early return by the Company to the Commission for increased rates is tenuous, and of insufficient weight to compel a policy conclusion based upon such apprehension.

"It is also observed that the moneys saved from income tax payments are funneled into present plant for the use of present customers, and that such moneys are derived from rates charged to the rate-payers. It is just, therefore, that the present rate-payers should derive the benefit therefrom."

The Commission is in error when it makes a statement of this nature. Under this kind of theory it could be argued that there would be no need to accumulate a sinking fund to redeem fixed obligation securities merely because they have a 30-year maturity.

The Commission thus having prescribed actual taxes and deducted the accumulated deferrals from the rate base, seemingly had second thoughts on the subject of attrition when it said in part:

"Giving consideration to the fact that attrition and erosion occurred, despite the inclusion in rate base of accumulations in the Restricted Surplus Account, for purpose of correcting for attrition and erosion, only, and not for rate base purposes, we shall add the sum of \$7,365,000, previously deducted from rate base as a result of amortization of emergency facilities, and we shall add for the same purposes the sum of \$2,396,200, previously deducted from rate base as a result of accumulations in the Restricted Surplus Account by the use of liberalized depreciation. This results in a rate base of \$260,754,667, which is adjusted for attrition factors, only. We again reiterate that this is not the rate base determined by the Commission for purposes of determining a reasonable rate of return, but

only for the purpose of correcting for attrition."

There is a curious lack of reality about the whole of the foregoing argument. The Commission on the one hand equates with tongue in cheek original cost with its statutory duty to find a fair value rate base, while on the other hand it gives modest recognition to inflation through the device of so-called "attrition and erosion." That this compensation for inflation is modest enough is seen by the fact that it amounts to only approximately 4% over net original cost through the device of adding back the tax deferrals and an additional 3% by increasing the allowable rate of return from 6.15% to 6.35%. A proper recognition of fair value would have increased the original cost rate base by at least 35% to 40%. Even during the last few years the construction dollar has suffered an erosion of at least 25%.

Determination of the Rate Base

The Commission dismissed all evidence of fair value on the grounds that such a determination must be based upon judgment and that the methods of arriving at a valuation "... are not an exact science." The Commission continued:

"On the other hand, 'Original Cost' is easily and accurately determinable; depreciation thereon is likewise accurately determinable. Thus, the net original cost of plant may be adjudged on the basis of actual investment, eliminating all speculation, guesswork, and error. 'Original Cost' also carries with it the undeniable fact that it represents the actual number of dollars that investors have invested in plant."

Presumably under this kind of reasoning, so-called "accuracy," no matter how erroneous the result which it produces will be superior to the fair and informed judgment

(Continued on page 39)

of a Commission's expertise. If mere bookkeeping is going to be a controlling factor at arriving at a rate base which is patently unfair to the investors who have already committed their dollars during earlier years, then there is certainly no need for engineers, lawyers and economists to be employed on Commission staffs, and for that matter there is probably no need for Commissioners as well. Anyone capable of running a calculating machine will have no trouble in making a rate base determination.

Rate of Return

With respect to the rate of return, the Commission here again made a correction for so-called "attrition and erosion" when it noted in part:

"It is emphasized, however, that these adjustments are solely for the purpose of attrition and erosion, and in no way constitute the finding of this Commission as to a fair rate of return and as to the rate base that we have previously found in our discussion above."

The Commission having found a fair rate of return of 6.15%, noted further that "... the Company should be allowed rates that will produce revenues resulting in this rate of return." The question might well be asked, if the foregoing rate of return is fair, why add 0.2% additionally for attrition? It is difficult to understand how both can be fair rates of return, unless the higher figure arrived at directly would have put the Commission in a politically untenable position.

Wis. Utilities Release "Master Tree Plan" Book

"Master plans" have been developed for more grandiose purposes, but seldom will they promise a greater potential in practical-esthetic accomplishment than does the goal of a little 20-page booklet recently published by five Wisconsin electric utilities.

"Master tree plans" are being encouraged by dissemination of the new booklet, along with street tree ordinances and other evidences of community planning in this area. The communities' goal of beautifi-

Educators Participate, Then Acclaim

Duke Power Co.'s Management Development Program

How do educators rate management development programs conducted by electric utility companies? How do they rate the utility people being trained in such programs? Reaction to Duke Power Co.'s "home grown" management development program which was recently completed by the first group of 36 participants offers a complimentary appraisal. (A three-stage course, it offers subjects ranging from basic economics to effective communication.)

For example, Dr. Walter Buckingham, professor of economics and industrial management at Georgia Institute of Technology and one of the lecturers in the course, has told Duke Power officials: "You have something to truly be proud of. I know of no other company which has had the amount of success with a management institute the first time it was tried. I have no doubt that if you continue the program, it will be even better although I've never seen anything quite like this. You have borrowed the best ideas from others and added some innovations of your own that have resulted in something unique and successful beyond what you could possibly have anticipated."

Another lecturer, Dr. C. H. Lawshe, Dean of University Extension at Purdue University, said: "The morale level of the registrants was extremely high. Whether this is something that has been generated as a result of the course thus far, or whether this is simply a character-

istic of these employees of Duke Power, I could not guess. I was impressed, however, with the high morale level and the seriousness with which the men undertook the activity."

The program under the overall direction of Duke Vice-President E. E. Williams, consisted of an orientation seminar and six monthly sessions of three consecutive days each. The sessions, conducted by both Duke Power officials and outside lecturers, were held at the company's Lake Hickory classroom and living facilities.

W. B. McGuire, Duke Power president, said the program was established to meet Duke Power's needs for developing management potential by giving participants the aids for self-development.

"Many firms have management development programs," Mr. McGuire said, "but we feel that ours is unusual in that the curriculum was established to meet our own specific objectives without the use of an outside management development organization."

He listed these objectives as: (1) providing a climate that encourages potential managers to develop themselves, (2) providing opportunity for potential managers to gain greater management skills, (3) determining individual progress by periodic appraisal and (4) providing a reservoir of key personnel, whose potentialities are known, to fill executive and administration vacancies as they occur.

cation, of course, is parallel to the practical utility aim of reducing service interruptions and tree-trimming and removal expenses.

The color-illustrated booklet is the result of a three-year research project financed by the utilities which employed a leading arborist as consultant. The book recommends more than 60 trees (such as little leaf linden) which are suited for city living in Wisconsin and which are not now commonly planted in this state.

The book advocates planting big trees in big spaces and small trees in small places. As simple as this

principle seems, it is not practiced. Forest giants are planted in the too narrow space between curb and sidewalk and in time grow too big for their space, heave sidewalks, plug sewers, obstruct street lights, break power lines, and become an expensive removal problem for the municipality, the utilities note.

They emphasize the fact that huge, brittle trees are the greatest single cause of electric service interruptions. "We'd like to improve that service and at the same time make the communities we serve more attractive, and a sound tree planting program will do both."



by RALPH ELLIOTT

Washington Editor

Compounded Error

When a court falls into error, it can usually be attributed to its having either jumped the established bounds of judicial review, misinterpreted the applicable law, or trapped itself with faulty reasoning. It is a rare thing, indeed, when one decision embodies all three errors.

But apparently that is the very thing which happened when a 3-judge panel of the U. S. Court of Appeals (D. C.) last month struck down the Atomic Energy Commission construction permit under which Power Reactor Development Co. is building the Enrico Fermi nuclear power plant at Lagoona Beach, Michigan.

If allowed to stand, the court's decision could frustrate, if not completely wreck, the entire power reactor development program fathomed by the 1954 Atomic Energy Act, and would cause a grave setback to this nation in the world race to develop peaceful uses of atomic energy. What link in the chain of legislative action and AEC practice could be weak enough to let this happen? The answer: there is none. The court in effect inserted a weak link of its own by misinterpreting the law, undertaking to substitute its judgment for that of AEC, and impugning the good faith of the administrative process.

The suit to void PRDC's construction permit was brought by a group of labor unions, headed by United Auto Workers, which claimed the proposed reactor would create a hazard to public safety and health, endanger the lives of the workers and their families, and depress the value of their jobs and homes. The court could not entertain the suit unless it found that AEC's order was a "final order" and that the unions were "aggrieved" by it. The course

taken in reaching an affirmative finding on both counts seems to have avoided firmly embedded principles of judicial review and appears rather to have meandered among sociological considerations.

The 2-1 decision was written by Judges Edgerton and Bazelon, who are generally regarded among lawyers as the two liberal extremists on the 9-man court.

Despite the fact that PRDC's provisional permit allows only construction (which the court concedes is harmless) and that a future operating license can only be issued on the basis of further and complete safety findings, the majority held that the permit order was final and that it aggrieved the unions. In other words, it accepted the unions' theory, as paraphrased by the court, that "construction would cause operation, and operation would cause injury." How come? Because, said the court, "it is plainly probable, in a high degree," that if construction proceeds an operating license will follow, regardless of the ultimate safety findings. The reasoning was that once large sums have been invested, "pressure to permit operation without adequate (safety) assurance will be great and may be irresistible."

Dropping its biggest bomb, the majority held that AEC must make the final, definitive safety findings required for the issuance of an operating license before it can even authorize construction. This finding was based on a "doubt" that AEC was correctly interpreting the Atomic Energy Act; and the "doubt," in turn, was based on a fragment of legislative discussion taken out of context. Actually, the discussion concerned certain procedures and economic objectives sought by government power-

minded opponents of the measure, and was wholly unrelated to safety standards.

Then, going completely outside the judicial purview, the majority condemned AEC's approval of the PRDC plant location—some 30 miles from Detroit.

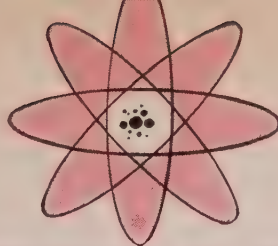
In a sharp dissent, Judge Burger contended that the suit was premature since the sole basis of challenge was that "the future possibility that an operating permit will be lawfully and improperly issued . . . creates a 'present,' 'immediate' and 'unavoidable threat' of injury." In an area of such scientific uncertainty, he said, AEC "must be permitted to proceed step by step." He added:

"I cannot join in the suggestion that members of the AEC who have assumed obligations under oaths as binding as ours would permit an operation dangerous to the public because 40 or 50 million dollars is invested in brick, mortar and steel by men who knew from the outset they were engaged in a scientific gamble."

Judge Burger also accused his colleagues of "undertaking to assume responsibilities which Congress vested in the Commission."

Both AEC and PRDC have filed petitions for a rehearing before the entire 9-judge court. The chances appear heavily to favor a review and reversal of the decision.

As it stands, the decision has an overlooked but noteworthy significance. It has handed a side-door victory to the government power forces who fought unsuccessfully in Congress against the program to foster private atomic power development. Under the decision's sweeping mandates, it is highly doubtful that anyone—other than the Federal Government—would be in a position to pioneer in the development of commercial size power reactors.



LOWERING THE COST OF POWER by one-tenth of a mill—thereby saving consumers an estimated \$200-billion in the year 1960—could be the mark of success for efforts to apply nuclear energy in the U. S., the AEC's reactor chief, Dr. Frank Pittman told a World Power Conference meeting in Spain last month. He said: "I am convinced that our efforts will have a much greater effect than this—whether through production of cheaper power, or by stimulating the fossil competition to greater efficiency—so that the relatively modest cost of our program will be repaid many times in lower, or at least, less rapidly increased, costs of electricity."

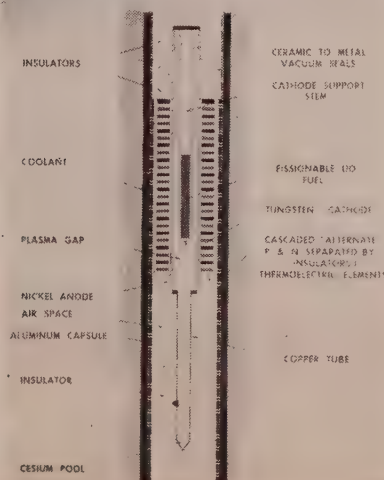
A GOOD DEAL OF LONG-TERM OPTIMISM is found on both sides of the Atlantic, in spite of much recent short-term pessimism about the prospects of nuclear power, the U. K.'s Sir John Cockcroft has remarked. In a talk on April 1, he noted: "If we look ahead to the end of the century, the world may be using energy at the rate of 10-billion tons or more of coal equivalent a year, of which electricity production alone is likely to account for more than a third. Even if hydroelectricity can provide 1-billion tons of coal equivalent, this still leaves an additional 5-billion tons of coal equivalent to be found, and most of this will have to come from additional oil production and from nuclear energy. The world will by then be only too pleased if nuclear power can generate the bulk of the electricity requirements."

IT WOULD BE IMPOSSIBLE TO BUILD A-PLANTS in populated areas where there is the largest economic requirement for electricity—if such a standard as the one indi-

"Nuclear hardware" for Hallam, Neb. project of Consumers Public Power Dist. enroute (Missouri river) and six weeks out of Baldwin-Lima Hamilton plant in Penn. Biggest piece is 80-ton reactor vessel; 65-ton containment tank later rolled off trailer into Nebraska cornfield.



FISSION FIRED COMBINATION THERMIONIC
THERMOELECTRIC DIRECT CONVERTER



cated in the majority decision of the Appeals Court on the Enrico Fermi plant were strictly construed. This interpretation reflected the principal concern of AEC. **AMERICAN NUCLEAR SOCIETY's** annual meeting last month produced numerous reports of progress in technology, of course. Here are a few:

LOWER RADIOACTIVITY DEPOSITS than were originally anticipated by GE engineers were found in the Vallecitos boiling water reactor and the associated steam system, after 8,000-hours of operation over two years. Surface contamination in the turbine was in the range of only one to three milliroentgens-an-hour at the surface—over half attributed to cobalt-60—permitting almost unlimited turbine maintenance to be performed.

BETTER THERMAL CONDUCTIVITY (by 30-percent) in fuel elements has been achieved by *The Martin Co.* through adding tiny fibers of molybdenum to uranium dioxide powder before inserting the mixture in thin cladding tubes. By simply swaging the entire assembly (instead of the more costly hot-pressing used in previous development efforts), density has been increased to between 84- and 87-percent of theoretical limits.

REACTOR RUNAWAY EFFECTS, studied under an AEC contract by *Stanford Research Institute* with scale (one-twenty-fourth size) models, are being recorded with high-speed photography. Strands of flexible metal tubing encasing explosive energy mixtures are placed in the model reactors, the energy and duration of the event controlled by the number of strands detonating at any instant. Pressurized water, boiling and swimming pool reactor types have been simulated.

Thermoelectric-thermionic generation (below) testing in the Westinghouse reactor at Walz Mill, Pa. was to be resumed this month . . . building on success of experimenters who last April produced about one watt of power, converting heat of fission directly into electricity.



Selling in the Sizzling

There are great opportunities for selling in the sixties, but the same old-fashioned techniques may not work. Bold, imaginative and consistent sales programs are needed.



The year 1960 ushers in a new decade—one which the economists generally agree will provide the greatest opportunities for growth of any decade in the nation's history. Among the many reasons for this growth are the expected resurgence of the marriage and household-formation rates—followed, in the natural course of events, by a step-up in the birth rate. Also, an acceleration is expected in the introduction of new products and new ways of doing things. There will be higher personal income, more leisure time, a greater diversity of interests, and a wider choice in spending.

Dramatic Sales Changes

This all adds up to greater competition for the consumer's dollar. And it has real significance for utility companies. The Sixties will present new challenges, new problems and will require new and dramatic changes in utility sales and public relations techniques.

Three Sources

The major part of the load growth nationally since the war has come

from just three sources: new homes—a field cultivated extensively by utility companies, air conditioning, and television—which the utilities have done virtually nothing to promote.

In the ten years between 1948 and 1958, average use per residential customer climbed from 1,563 kwh to 3,366 kwh—an increase of about 1,800 kwh. We estimate that roughly 110 kwh of this increase came from television; 260 kwh came from air conditioning; and 870 kwh came from new homes built during the 10-year period. The remainder, or 560 kwh, came from all other sources.

If we remove these three major sources from the growth rate in kilowatt-hour sales per customer, we find a rate of only 3.1 percent, instead of the 8 percent rate that has generally prevailed.

This is another way of saying that the customers who have been on utility lines for 10, 20 or 30 years are not using much more electric service today than they were at the end of World War II.

It has become increasingly clear that, except for television sets and air conditioning units, people have

By **W. L. BYRNE**, Assistant Manager
Sales & Public Relations Department
Ebasco Services, Inc.

Seven Steps To Successful Sales In the Sixties

1. Find out what is actually going on in the market place.
2. Determine the market potential of profitable applications of service, in each customer classification.
3. Apply fresh approaches to tried and proven methods of creating sales—find out what works and why.
4. Throw off the taboos and inertia that were the natural outgrowth of a long-sustained seller's market.
5. Elevate professional competence to the Number One spot in selecting sales personnel.
6. Develop the most effective and efficient program possible.
7. Implement the program strongly.

not been made to want electric appliances badly enough to forego other and more impressive symbols of social status. There is very little built-in glamour or sex appeal in the average household appliance. True, the housewife may grumble occasionally about her domestic inconveniences, but she will put up with a lot before she voluntarily gives up a new automobile, a vacation trip, a fur coat, or wall-to-wall carpeting, in favor of a new appliance that she has never owned before.

High-saturation items can be sold by mass promotion. Obsolescence usually does the trick. Take automobiles, for instance. Make them longer, wider, lower, put in more horsepower, expose them to enough people through TV and other mass media, and the family simply has to have one to impress the Joneses.

Refrigerators are another example. Change the shape, the size, the color, add a freezer chest, buy a national television show, and your old "frigidaire" becomes obsolete overnight.

But it is pretty hard to make people dissatisfied with something they

have never had. Until we reach a high saturation of such items as dish washers, ranges, water heaters, freezers, dryers, lighting, and house heating—mass promotion alone is not enough. Someone still has to do a creative selling job, and more importantly, ask for the order.

Manufacturers

Undoubtedly, we can point one finger at the manufacturers. Year after year we find them fighting among themselves for a bigger share of the same total, with almost no attempt to broaden the market. But then, that's their business. They do not have to make appliances at all unless they want to. All they have to make is money, and if they think it's easier to make money by trying to take the existing market away from their competitors, or by branching out into competing lines of equipment, those are problems between them and their stockholders.

Dealers

Another finger could be pointed at the dealer, but like the manufacturer he doesn't have to sell appli-

ances either. All he has to do, too, is make money—and that has become increasingly difficult for him each year.

He got pretty discouraged when he saw his customers shopping around for better prices and finally ending up in a discount house. None of his sales people had ever been faced with competitive selling and so he was at a loss to know what to do. First, he cut prices until his profits reached the vanishing point. Then he began to branch out, taking on competitive lines of appliances and whole new lines of unrelated items such as garden furniture, barbecue equipment, boats and outboard motors.

We may generally agree that the manufacturer and the dealer are, from our standpoint, dead on their assets, but there is little we can do to force them into selling appliances more aggressively.

Utilities

Now, let's point the rest of our fingers at the utility industry itself. Anyone addressing a group of utility executives is in a good position.

He can be as critical as he likes, and always appear to be talking about someone else, because actually we're not an industry but a collection of independent companies with just about as many variables in method and scope as there are industry members.

Some companies are enthusiastic about quick recovery water heaters. Some are passive. Others will not permit them on their lines. Some companies like electric house heating. Others don't. Some merchandise. Many do not.

Some have been successful in enlisting the active sales support of all company employees. Others leave it entirely to sales personnel. A few companies promote residential lighting aggressively. Many say it is too costly.

There are similar differences of opinion on virtually every sector of the utility sales front. Little wonder that our national promotions, by the time they see the light of day, have been watered down until they have lost much of their sales punch. "Live Better Electrically" is a nice phrase but not likely to stampede your customers into an appliance-buying spree.

Existing Home Market

But how do we reach the existing home market? Most utilities,

even those who merchandise, rely heavily on dealers to close sales. Since virtually all residential sales effort is designed to create a market for dealers, it is interesting to note what the dealers think of utility sales effort. In a recent survey of more than 6,000 dealers in 16 states scattered geographically across the nation, their actions are most revealing:

- ▶ 30 percent rate the utility representative's visit as being of "limited value."
- ▶ 32 percent believe utility advertising has "no effect on their sales."
- ▶ 36 percent rate utility display material—when they receive any—of "limited value."
- ▶ 35 percent rate the utility's dealer magazine—if they receive one—"interesting but not helpful."
- ▶ 37 percent rate utility sales campaigns "of limited value" in increasing appliance sales.

In several cities dealers have been asked point blank, "What would happen to your appliance sales if the utility were to stop everything it is now doing to promote sales for you?" The answer they give is, "Nothing." This is their honest opinion. They simply cannot relate any of the dollars in their cash registers to the utility sales program.

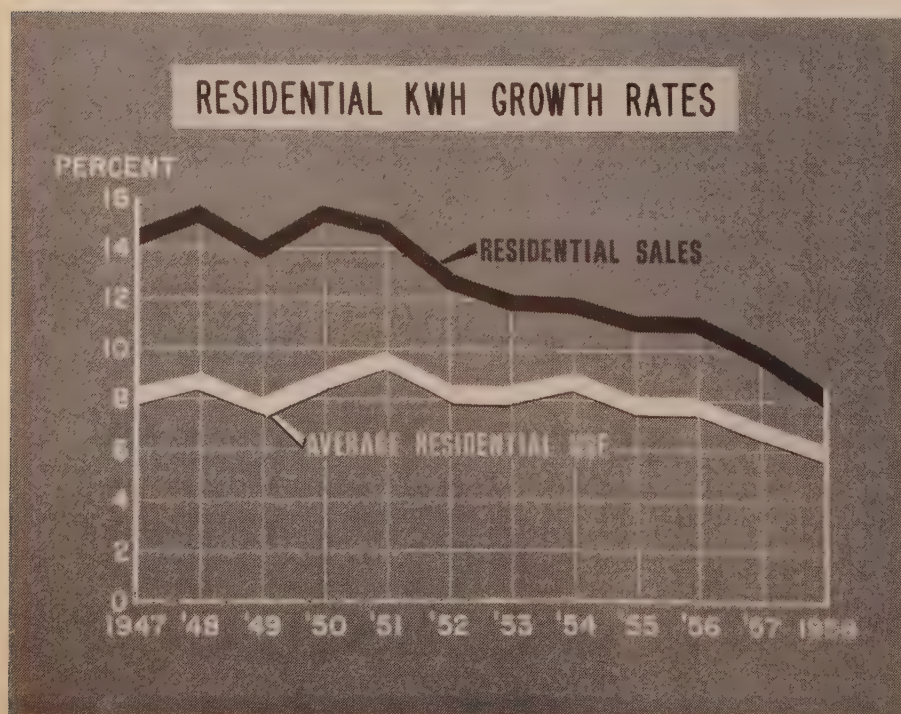
Budgets Inadequate

What to do about it? Inescapably we come back to that five-letter word—Money. It seems apparent that the utility sales budget is entirely inadequate to appreciably affect the existing home market. Man- and woman-power have been reduced to the vanishing point, and many of those who are on sales payrolls gravitated there, or were transferred from other departments without the basic skills, training and experience to qualify them for their jobs. This is so frequently evident with the dealer coordinator, who should be a top performer if the dealer is to become the cornerstone of your sales program. Yet dealers tell us time and again that they think the dealer representative is a good Joe, but—he knows virtually nothing about the retail appliance business.

What to Do

What should utility management do about all this? Here are some thoughts you may want to pass along to your sales people. Tell them to let their imaginations run and make a clean break with tradition.

If your company is not paying bonuses for dealer sales, maybe it should. If it is not offering free wiring maybe it should. If it is



Although usage of electricity by residential customers continues to grow, the rate of increase is decreasing steadily. This points out the need for utilities to sell their product, long and hard, to every customer. Bold, imaginative, and consistent sales programs are a must.

not selling merchandise, maybe it should—on a selective basis.

If your company doesn't have anyone out calling on customers to sell home lighting, maybe it should. Why shouldn't it make good sense to pick out one territory in your service area and give these ideas, and some new ones of your own, a real country try. Select the ones that work best, discard or modify the others until they do work, and then spread them out over your entire system.

Residential Lighting

Residential lighting, for example, has paid real dividends to the few companies who have consistently and aggressively sold Light for Living. The returns have averaged well over a dollar of recurring annual revenue for each dollar of sales cost. I have heard utility executives say that this might be all right for a small company, but it was out of the question for them, because they were a big company and it would cost too much money to cover their market. Yet on a per-customer basis, a program of this type would not cost the big company as much as the little one. Sure, it will take a lot of dollars, but they are not being poured down a rat hole. They are an investment in the sound financial future of your companies.

And lighting is one thing that will help most utilities improve their load factor—and thus net revenue. This goes also for space heating, electric blankets and a lot of other low-saturation items. Get hold of some load and market research and put your sales people to work selling the things that improve load factor.

Commercial and Industrial

Commercial, industrial and governmental customers account for 70 percent of total electric sales and 56 percent of your revenues. And yet, most utilities spend only 30 percent (or less) of their salary and sales promotion dollars on this rapidly-expanding receptive market.

In most utilities which we know about, the commercial and industrial sales staff is so small and so busy it is barely able to handle request calls that come into the office.

They are busy doing commercial engineering, negotiating for contracts, and getting service to new supermarkets, factories, and offices. They admit they rarely have any time to do any creative selling.

Now, I'm not suggesting that these very essential customer services be eliminated. But I am questioning whether the time involved in these customer functions should be charged to sales expense.

Sell Existing Customers

The same situation exists in this field as I described for the residential market. Most of your sales people are necessarily devoting almost all of their efforts to new construction, and the existing customers are completely left alone. They are not being sold additional use of your service—and almost as important—they are not being sold on your company and its important place in the community.

Some utility people say there's no business there and they can't afford to call on these little customers. Well, how much do we actually know about the true sales potential? Take lighting, for example. Sylvania Electric has been doing some exhaustive research among small commercial and industrial users and their findings are quite revealing. In city after city, many of these small customers (as high as 30 percent) volunteered to the interviewers that they were dissatisfied with their present lighting and wanted to improve it.

But, at the same time, the survey also shows that this small customer doesn't know where to turn. He looks upon the utility as being too big to be interested in his small problems. He feels that any action or help emanating from the utility would cost too much. He doesn't have a contractor with whom he works regularly; he knows he couldn't afford an architect. So he sits there, while his modernized competitors continue to take business away from him.

Other Applications

Then there are other things besides lighting which could be helping to build better load factor. Such applications as refrigeration, cook-

ing, process heating, electrical signs—and space heating.

There isn't space to cover this commercial and industrial market as it deserves. But I do want to discuss whether we can afford to call on these customers.

Success Story

Here is an example which illustrates what one company found out about this angle. One of our clients in the midwest had been rocking along with the "normal" type of sales program ever since the war. There wasn't enough manpower. Only request calls were taken care of. No real selling was being done. It had been years since some of the small commercial customers had seen a utility salesman.

So it was decided to see what could be done. Four new, young salesmen were recruited. They weren't engineers; they were chosen because of their "selling" attributes. They went through an intensive 2-month training course, and then they were sent out to call on every customer in their assigned territories—door to door.

Here are the results. In the first nine months of 1959, these four men made 6,355 sales calls and reported \$241,000 in new revenue. But more importantly, by carefully separating the new business which was a direct result of their own efforts from all of the new business in these territories, the record shows that they were personally instrumental in adding \$91,000 in EAR in nine months. This is \$14.34 per call, or \$4.95 of annual revenue for every dollar of salary.

This trial has been so successful that two more men have been added and are being trained. They will soon take their place alongside the others in this effort to build more business from the existing small commercial and industrial market. And, I should add a little footnote here—customer relations have improved also!

There are great opportunities for selling in the Sixties, but utility management should realize that the same, old-fashioned techniques may not work. We need bold, imaginative and consistent sales programs. And undoubtedly we need to spend more money!

TIE-HEAD LINE POST



Up-to-date version of Lapp's original Line Post—the insulator with a 29-year service record of high-security operation. Inexpensive tie-wire installation provides a "mechanical fuse" when conductor breaks. New wide-throat conductor grooves on all units rated to 88 kv. The industry standard for most applications.



CLAMP-TOP LINE POST



Clamp attachment particularly adapted to large aluminum conductors with armor rods. Best for use in hilly terrain. Simplest installation, easiest for hot-line maintenance, and eliminates tie-wire loosening.



HORIZONTALLY-MOUNTED LINE POST



Save up to one-third in materials—more in labor of erection—with armless construction using Lapp Line Post with integral base-and-gain. Permits longer spans, larger conductors, greater safety margins. Eliminates contamination flashover, pole-top burning.



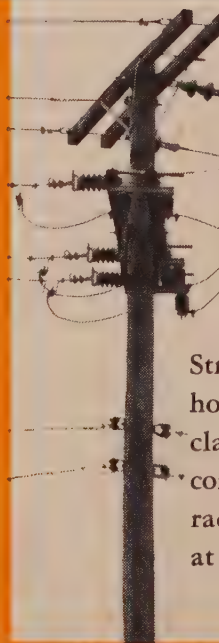
4 ways

to build economy
...and better performance
...in sub-transmission construction

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Strain clamps supported by horizontally-mounted clamp-top Line Posts provide convenient, good-looking, radio-free slack-span support at sub-stations and line taps.



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LeRoy, New York.



Lapp

PS&G's Load Dispatching Center Is BIG

A \$1½-million electric load dispatching center with a panel board 10½-ft high and 210-ft long—the largest of its kind in the United States—has been placed in operation by Public Service Electric and Gas at its Terminal Building in Newark, N. J. This installation is planned to serve the company's needs in the northern area for the next 25 years.

Three load dispatchers, always on duty at this center, control the operation of the northern portion of the system from Ridgewood to New Brunswick. Another dispatch center at Burlington Generating Station controls the remainder of the system to below Camden. Combined, these centers control system output of over 2800 mw and the exchange of power with four interconnected companies. This pool has over 12,000 mw of capacity at its disposal.



John A. Harlow, engineering assistant at PSE&G changes a tape on one of the seven SoundScriber tape recorders-reproducers used to monitor all telephone conversations made by load dispatchers in the newly-completed Communications Center adjacent to this tape recorder installation. The company has an accurate record of all telephone transmissions between its several dispatchers and field repair teams since the tapes used are practically impossible to alter.

Allen Station Uses Galvanized Steel Lagging

Use of galvanized steel sheets for covering the insulation of boilers, ducts, and other steam generating equipment, has solved problems inherent in the traditional covering, the Committee on Galvanized Steel Sheet Research reports. In a large project for Thomas

H. Allen Electric Generating Station in Memphis, Tenn., the half-million sq ft of galvanized sheets for the lagging job were shown to be easy to fabricate and competitive in cost with cement.

At the same time the galvanized steel sheets will not be subject to cracks as a result of heat and aging, and they are not vulnerable to mechanical damage to the same extent as cement lagging, CGSSR claims.

Special treatment of the sheets also permitted immediate painting of the lagging, which was specified by the company, while retaining the corrosion protection of the zinc coating.

CG&E Puts Generator Through Station Window

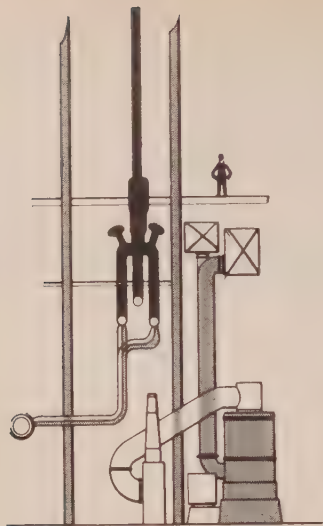
When Cincinnati Gas & Electric installed its 165-mw Miami Fort Station generator recently, it used jacks and blocks to get it into the building. The 480,000-lb, 28-ft long, 15-ft diam. unit was moved through the window to its foundation on the turbine room floor.

It arrived from the General Electric plant at Schenectady, N. Y. on a special-built flat car. Railroad tracks were laid from the railroad siding at the plant to the window of the station.

Four 100-ton air packs lifted the unit about a foot at a time. Blocking was placed under the generator after the jacks had lifted it. This process was continued until the generator had reached proper level for rolling it onto the turbine room floor, about 20 ft above ground level.



Cincinnati Gas & Electric's "jacked up" generator rolls smoothly through Miami Fort Power Station window. It is the first time CG&E tried this.



By **J. I. ARGERSINGER**,
Chief Project Engineer,
Combustion Engineering, Inc.

FACTORS that influence utility boiler design are in a large measure associated with requirements and objectives of the industry. Two industry characteristics, in particular, have a decided influence on boiler design. One is the industry's tremendous rate of growth; the other is its constant striving for higher and higher efficiencies.

The growth factor is not news but it has greatly affected equipment design; for, with the increase in electric load larger unit sizes have become economic. Just five years ago our market research group predicted that a 500-mw unit would be contracted for by this year. This estimate was too conservative. We contracted for a 500-mw unit in 1957. Now, even larger units are being designed and studies are under way in the 700 and 800-mw range. Such capacities are economical only in large systems where a heavy load is concentrated in a small area, but the tendency is reflected everywhere.

The 500-mw unit mentioned has a number of features which are typical of large units. The boiler is of the twin furnace design, each furnace 40 feet square and 150 feet high. Overall height to the top of supporting steel is about 200 feet. The unit is tangentially fired with pulverized coal through tilting

Trend to larger size units and constant striving for greater efficiencies have created many new problems; solving them promises still further advancement in reliability through improved materials and fabricating methods, design, operating procedures, and more dependable auxiliaries, instruments, controls and interlocks.

CHANGING FACTORS IN UTILITY BOILER DESIGN

burners which automatically regulate steam temperature. The boiler is of the controlled circulation type, with circulating pumps to provide positive and ample head for circulation, and orifices in the waterwall tube inlets to provide proper and stable distribution of flow to the many parallel circuits. The controlled circulation principle is generally applied in the pressure range above 2000 psi and below the critical pressure 3200 psi. The design is especially advantageous in large units where it may be difficult to maintain uniform furnace conditions in all parts of a large combustion chamber.

Advantages and Disadvantages of Size

In general, efficiency of the boiler and more especially the turbine is higher in large unit sizes; installed cost per kw is lower; and the number of operating personnel per kw is lower.

On the other hand, use of large units means putting many eggs in one basket. A very high degree of reliability is obviously required. At the present time, availability records of 95 per cent and higher are expected and obtained in commercial operation. This may be considered an excellent achievement, but further improvement is constantly sought. Improved reliability involves development in metallurgy and general selection of materials, fabricating methods, boiler design and operating procedures, and more

reliable auxiliaries, including instruments, controls, and interlocks.

Automatic controls have become a practical necessity with large units, and the increased use of automation has been justified by demonstrated improvements in operating efficiency and reliability. There are now being installed several plants which will be completely automatic. In the engineering of these plants, a new and closer look is being taken at integration of all controls and instruments. Operating procedures are being carefully programmed and coordinated. And, the dynamic characteristics of superheaters and other boiler components are being critically analyzed. It is too early to appraise the effect of this study, but it seems inevitable that such painstaking and highly competent analysis will bear fruit in the form of improved design, operating techniques and instrumentation.

Flame monitoring and prevention of furnace explosions is one of the areas that has been highlighted in the study of plant automation. It has generally been considered in the past that cutting off the fuel supply is the universally safe practice in case of flame failure. Recognition is now given to the fact that flame failure may be caused by a relative deficiency of air, and tripping the fuel may then produce rather than avoid explosive conditions. The complete answer to this problem is not yet developed, but it is surely one of the most important items being studied in connection with push-button plants.

Editor's Note: This is an adaptation of a paper presented by the author at the 31st Annual Engineering Conference of the Missouri Valley Electric Association, April 1960.

One of the undesirable features of a large unit is cost of the steam piping required to transport steam from the superheater outlet to the turbine throttle, and (usually) to and from the reheater. This cost is aggravated by the general use of high pressure and high temperature which normally accompany high capacity. In some cases, cost of piping alone is measured in millions of dollars. The obvious answer to this problem is to locate the superheater outlet as close as possible to the turbine throttle. A number of units have been designed with the superheater outlet in front of the boiler rather than on top. The low-head or "ranch-type" boiler locates the finishing superheater beside furnaces, rather than above.

A further development is the top fired boiler in which burners are located in the upper part of the furnace, and the furnace outlet is near the bottom. The finishing superheater is at the level of the furnace outlet, and the superheater outlet header is at about the height of the turbine floor. This design also provides economy in the amount of supporting steel required, since much of the weight is at a relatively low elevation.

Peaking Capacity

Along with growth of utility load has come the need for peaking capacity. Since the use factor on this capacity is low, installed cost should be low, and operating efficiency is much less important than in the case of base loaded equipment. Diesel-generator sets have been successfully applied in some cases. Gas turbines and combination gas-steam cycles are also of interest. In the field of steam only, two methods at least have been proposed to provide short time overload with minimum departure from conventional design. One method is to lower steam temperature and raise operating pressure, thereby making it possible to pass more steam through a given turbine.

The other method is to generate extra steam in the boiler and bypass it around the high pressure turbine to the reheater or direct to the reheat turbine. The finishing stage of the superheater may

also be bypassed. This scheme is particularly attractive if combined with a bypass system used for normal starting or hot starting and matching steam temperatures to turbine temperature. Extra kilowatts are produced at a lower efficiency, but installation cost is much less than for equipment of usual design. For short time operation, furnaces can be operated at higher than normal release rates. Spare pulverizer capacity is probably not required. Many other design factors can be less conservative than for base load operation. This does not and must not introduce any reduction in safety, but can reasonably be based on a somewhat shorter expected operating life.

Efficiency

So far we have been discussing factors which are generally related to growth of the utility industry and "bigness." Let us now consider the second outstanding characteristic of the industry, which is associated with "littleness." I am referring to the remarkable achievement of consistently reducing cost of electricity in the face of rising prices and wages and general inflation. To make this possible utilities have demanded and obtained equipment of higher and higher efficiency.

Some efficiency gains take place in the boiler room. Others occur elsewhere in the plant but have a strong influence on boiler design.

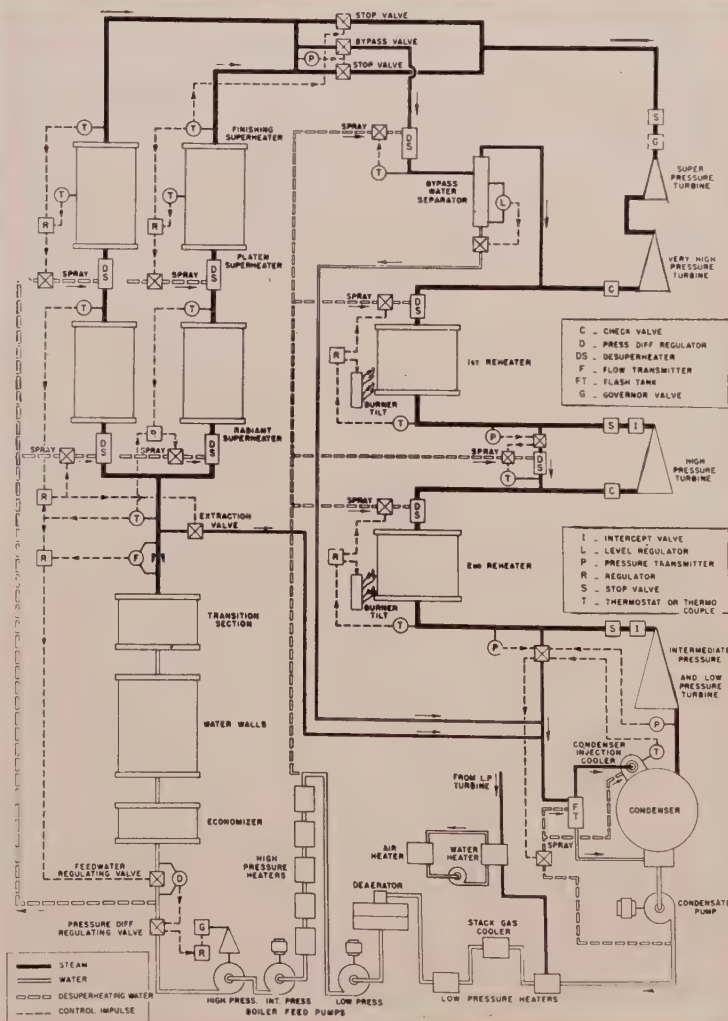


Fig. 1—Cycle diagram for Eddystone Unit No. 1. Diagram shows turbine bypass system, and also stack gas cooler and closed circuit steam-water-air heater.

In the boiler, the largest single loss is the heat that goes up the stack. Over the years, air heaters have been made bigger and bigger in an effort to minimize stack loss. Today we have gone about as far as we can in this direction. In many plants air heaters have reached the maximum size possible because of basic thermodynamic limitations. Low temperature corrosion is also a limiting factor in air heater design and operation.

A new device that is being tried in several plants is the stack gas cooler or low temperature economizer. One of the most interesting and effective applications has been made at the Eddystone Station of the Philadelphia Electric Company. In this case the stack gas cooler replaces the second feed-water heater. Condensate is raised from 160 F to 190 F, and flue gas is cooled to about 200 F at full load. Associated with the stack gas cooler at Eddystone is a steam-water-air heater. Extraction steam below atmospheric pressure is used to heat water which flows in a closed loop and transfers heat to the air entering the air heater, to maintain the desired cold end metal temperature. Use of the closed water loop permits use of sub-atmospheric steam without danger of an air leak into the condensate. The air heater and stack gas cooler are completely separate, and can be operated independently of each other in accordance with load and ambient conditions.

There are, of course, other ways in which the stack gas cooler can be arranged, with heat being used directly for air heating or other purposes. The device is characteristically made of cast iron extended surface. This design provides relatively low cost, moderately corrosion resistant surface. Since it must work with a small temperature differential, a large amount of surface is required. The cost, therefore, is considerable and probably can be justified only for units where fuel price and load factor are high.

Outside the boiler room, efficiency gains are being made by use of higher steam pressures and temperatures. The latter are generally limited by metallurgical considerations. However, this subject is being constantly studied, in the

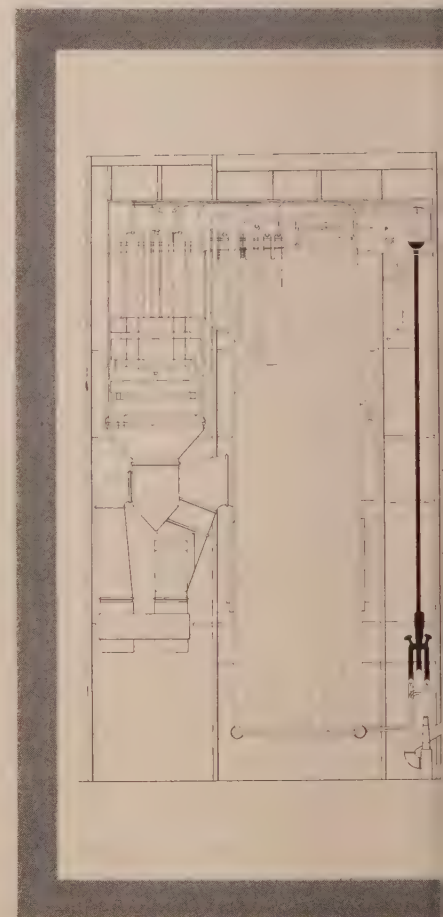
areas of new alloys and closer production control.

Rising steam pressure has been accompanied by many changes in boiler design. The controlled circulation boiler has been mentioned. For operation above 3200 psi we turn now to the once-through unit. Although they are unfamiliar in this country, once-through boilers have a background of more than 30 years in Europe. The Eddystone plant, again, is an example of American installations. The number one unit is rated at 325 mw. Steam is provided by a CE-Sulzer monotube boiler at 5000 psig and 1200 F throttle conditions. Two stages of reheat are included, both at 1050 F. Net plant heat rate is expected to approach 8000 Btu/kwh, representing a big step forward in fuel economy. Boiler capacity is 2,000,000 lb steam per hour. It is a twin furnace, pulverized coal fired unit. The design is characterized by the use of radiant superheater surface to cover the roof and upper third of the furnace walls. The lower two-thirds are waterwalls. Platen surface is also used for superheating and reheating, platens occupying the top 20 per cent of the furnace from side to side and front to rear.

The Eddystone unit was followed closely by another supercritical pressure monotube boiler at Avon Station of the Cleveland Electric Illuminating Company. That unit is rated at 250 mw with steam conditions of 3500 psig, 1100 F/1050 F. As is normal with once-through boiler installations, both plants are equipped with turbine bypass systems. The bypass provides for 30 per cent of maximum flow to be maintained through the boiler during startup, and permits establishment of the desired steam pressure and temperature for starting the turbine. Initially water is pumped through the entire boiler and superheater and through the bypass valve into a water separator. From there the water is discharged under automatic level control to the condenser hotwell. During startup the boiler pressure is regulated automatically by the bypass valve.

When water flow has been established, the unit is fired and the temperature at the superheater outlet starts to rise. When steam is

formed it flows from the bypass water separator to the first reheater, through a second bypass valve to the second reheater, and finally through a third bypass valve to the condenser. There is a desuperheater following each bypass valve to protect reheaters, piping and condenser against excessive temperature. When the steam temperature is proper, the turbine ad-



mission valves are opened and the flow is transferred from the bypass system to the turbine, with the generator picking up load at a controlled rate. During the transfer, bypass valves close automatically under the pressure control. When the bypass valves are completely closed, the pressure control is taken over by the combustion control system, either on manual or automatic. When shutting down, the unit may be bottled up to maintain pressure and temperature, or it may be cooled at a regulated rate by use of the bypass system.

For a hot quick restart, an extraction valve is provided, di-

charging from the transition section outlet into the bypass system at the separator. A portion of startup flow can thus bypass the superheater, thereby minimizing temperature changes in the superheater and steam piping. For normal operation, the bypass system provides a back-up protection against excessive swings of pressure or temperature in either direction.

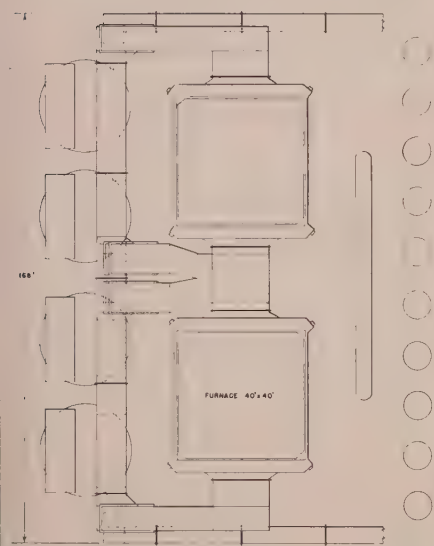


Fig. 4—High capacity, twin furnace, controlled circulation boiler of the Tennessee Valley Authority's Widows Creek Steam Plant, Unit No. 7 (200 mw) 3,850,000 lb steam/hr, 2450 psi, 1050 F/1000 F

Although we have considered the bypass system as an adjunct of a once-through boiler, it can also be used, and is being used, with drum type boilers. It is of particular value where hot restarts are frequent in occurrence. It also contains the same components as are needed for the type of peaking operation mentioned previously.

The two supercritical monotube units have at present only a short history, but they have already won high praise from their operators, and they give every indication that change to supercritical pressure steam generation can be made with efficiency and reliability.

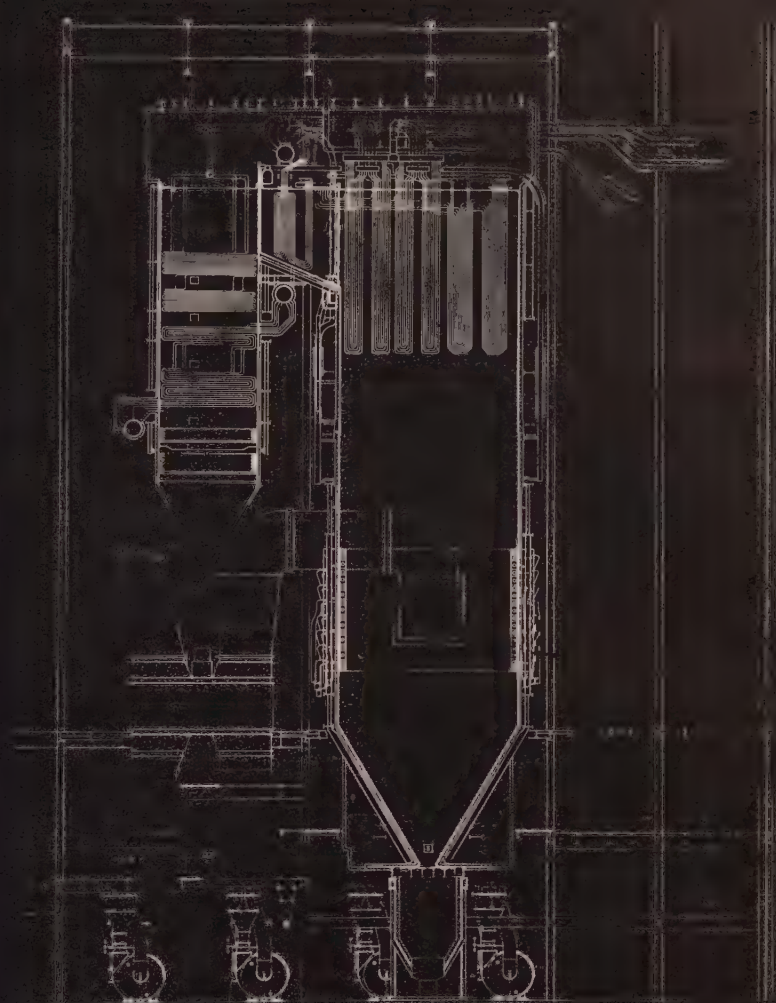
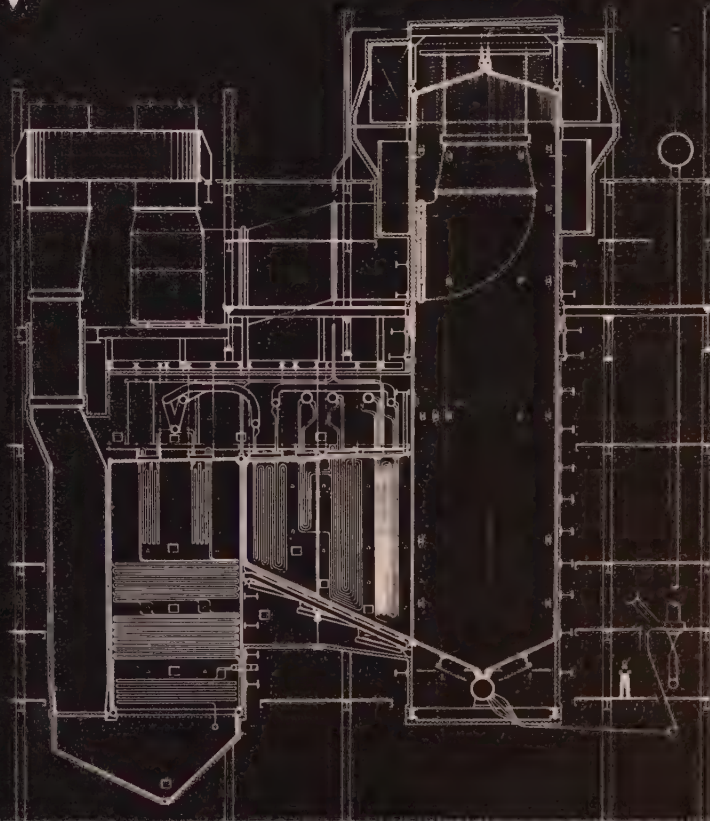


Fig. 2—Top fired unit of Gulf States Utilities Company's Sabine Power Station, Unit No. 1 & 2. (200 mw) 1,584,000 lb steam/hr, 2250 psi, 1000 F/1000 F

Fig. 3—Supercritical pressure monotube boiler of Philadelphia Electric Company's Eddystone Station, Unit No. 1. (325 mw) 2,000,000 lb steam/hr, 5000 psi, 1200 F/1050 F/1050 F



TRANSFORMER LOSSES AND LOSS RATIOS

By KENNETH W. KLEIN,
Distribution Engineer,
The Cleveland Electric Illuminating Company

Careful analysis of transformer costs and loads will indicate any desirable changes; cost and loss factors should be accurately determined since they are the basis of all calculations; objective should be the best compromise for all.

WITHIN THE past two years a great deal of interest has developed among distribution engineers on the subject of transformer losses. Even those engineers that previously were unconcerned about these costs were brought face-to-face with the problem since the industry now has available transformers with new loss designs which must be evaluated.

This discussion shows how an evaluation of losses can precipitate a change in transformer design. Also a simple, concise method for calculating these costs is developed. Specific cost data is unimportant, and is used only to show a method of approach to the various factors.

Economic Analysis

No matter how complete and correct an economic analysis may be, the whole study may be clouded over and misunderstood unless the terminology is clear. Some people refer to their costs as first cost, others as operating cost, annual cost, or capitalized cost. Each one can mean something a little different than the others. For this type of study the annual cost method is most desirable. There are, however, several components to this: 1. Annual Cost of Copper Losses; 2. Annual Cost of Core Losses; 3. Annual Cost of Regulation; 4. Annual Cost

Symbol Factor

- A ---- Load factor of the transformer
- B ---- Loss factor of the transformer
- C ---- Power factor at the secondary terminals at peak load
- D ---- Fixed charge rate
- E ---- Transformer size in kva
- F ---- Copper loss of the transformer in kw
- G ---- Core loss of the transformer in kw
- H ---- % Regulation of the transformer @ .8 P. F.
- I ---- % Regulation of the transformer @ 1.0 P. F.
- J ---- % Exciting Current
- K ---- Cost of the transformer in dollars
- L ---- Copper loss investment charge @ 100% load in \$/kw
- M ---- Core loss investment charge in \$/kw
- N ---- KWHR production cost for losses in \$/kwhr
- O ---- KW production cost for losses in \$/kw
- P ---- Per unit load on the transformer
- Q ---- Cost of capacitors in \$/kvar
- R ---- Value of net increase in revenue in \$/kwhr

of Exciting Current; 5. Annual Cost of Fixed Charges on the Initial Investment.

The first four items are basically *Operating Costs* while the fifth is *Fixed Charge*. By converting them to annual costs, they may be added directly into one factor—*Total Annual Cost*. It is, therefore, conceivable that the overall minimum annual cost of a transformer may be reached by increasing the *Fixed Charges*, if the *Operating Costs* are lowered enough to counteract the increase.

There are at least two ways to lower operating costs of a distribution transformer. One way is to lower total losses, and the other way is to change the ratio of copper to core losses. Of course a change in regulation and exciting current will affect annual cost; however, this is usually a function of change in loss design.

System Parameters

Before any costs can be applied to a study such as this, certain characteristics of the system must be determined. Each of these factors will alter the cost analysis, and the study as a whole will be no more accurate than the least accurate of the factors. It is, therefore, very important that as much care as possible be given each item.

It may be helpful if here at the beginning of our discussion all of the cost, load, and system factors be listed along with an arbitrary sym-

Editor's Note: This article is adapted from a paper presented by the author at the Pennsylvania Electric Association Transmission and Distribution Committee Meeting November 1959.

ol. This will allow us to refer to them later on and all of us know to what we are referring.

Development of the Total Annual Cost Factors

As outlined, there are five cost factors in the Total Annual Cost. These we will consider individually.

Copper Loss

This is usually divided into two parts: 1. The investment or demand charge; 2. The production cost.

The *investment charge* must be developed from the actual valuation of the system from the generator out to the transformer. Consideration must be given to the coincidence of the transformer peak load relative to the system peak load.

The *production cost* is essentially the coal cost plus whatever overhead charges that may be incurred for producing a kwhr of energy.

Since copper loss of a transformer varies as the square of the load, cost of the losses must be multiplied by the per unit load on the transformer squared.

Annual Cost of Copper Loss = 1. Annual copper loss investment charge = (L) (F) (P²) plus 2. Annual copper loss production cost = [B (8760 hours) (F) (N) + O) (F)] P²

Core Loss

This cost, as the copper loss is divided into two parts: 1. The investment or demand charge; 2. The production cost.

The *investment charge* for core loss also must be developed from the actual valuation of the system from the generator out to the transformer. Since the core loss is on the lines all of the time, there is no diversity between the system peak load and the transformer core losses.

The *production cost* is the coal cost plus whatever overhead charges may be incurred for producing a kwhr of energy.

Since core loss is not a function of load, the entire burden of these losses must be born throughout the entire year.

Annual Cost of Core Loss = 1. Annual core loss investment charge = (M) (G) plus 2. Annual core

loss production cost = (8760 hours) (G) (N) + (O) (G)

Regulation

This method of evaluation is based on net increase in kwhr sales due to a higher voltage on the secondary of the transformer. This differential in voltage is due to a lower % Regulation of one transformer over its neighboring one. If there were two transformers each serving a secondary distribution with identical load characteristics and these distributions were adjacent; also, if transformers were identical except for the % Regulation; then the only advantage that the one with lowest regulation would have would be its ability to produce more kwhr due to a higher secondary voltage.

If these increased net kwhr's are multiplied by the appropriate \$/kwhr, the net increase in revenue is realized.

Assume that 30% of the connected load is affected by a voltage change, and that a 1% change in voltage produces about a 1.6% change in kwhr consumption on this voltage-sensitive load, then the change in consumption due to regulation at rated load, continuous, will be: kwhr increase = (8760 hours/year) (30%) (1.6) (E) (C) (% Regulation at load power factor) = 420 (E) (C) (% Regulation at load P. F.)

At any other steady load of P (per unit of transformer rating), both load and voltage drop will be multiplied by P, giving: kwhr increase = 4200 (E) (C) (% Regulation at load P. F.) (P²)

For a cycle of changing load (such as a normal daily load cycle) the effect on the kwhr will be as the square of load cycle. Since the square of the load cycle is the loss cycle or equal to the loss factor, the above formula now becomes: kwhr increase = 4200 (B) (E) (C) (% Regulation at load P. F.) (P²) the % Regulation is either (H) or (I) when the load power factor is 80% or 100%.

Multiplying this by the Value of Net Increase in Revenue (R) gives the dollar value of the regulation.

In some cases it may be more desirable to evaluate the increased loadability of a transformer with

lower regulation rather than the value of increased revenue. This must then reflect the savings in reduced number of changeouts and lower average investment per unit.

Exciting Current

The most practical way of counteracting the var requirement of the transformer is by installing capacitors.

Annual cost of Exciting Current = (J) (E) (Q) (D).

Fixed Charges on the Initial Investment

In order to incorporate a capitalized investment cost into a study using annual costs, it is necessary to convert these capitalized dollars to annual costs by multiplying by the Fixed Charge Rate.

Annual Cost of Fixed Charges on the Initial Investment = (K) (D).

System Economics

Now the foundation of our economic analysis has been laid. Let us pick some arbitrary values for the load and cost factors so that we may illustrate the possibilities of this analysis.

Symbol Factor & Assumed Value

A	Load Factor	= .40
B	Loss Factor	= .20
C	Power Factor	= .80
D	Fixed Charge Rate	= 15%
L	Cost of Copper Loss Investment Charge @ 100% load	= \$25/kw
M	Cost of Core Loss Investment Charge	= \$35/kw
N	KWHR Production Cost for Losses	= \$.005/kwhr
O	KW Production Cost for Losses	= \$4.50/kw
P	Per unit load on Transformer	= 1.0
Q	Cost of Capacitors	= \$18/kvar
R	Value Net Increase in Revenue	= \$.016/kwhr

(Continued on next page)

Substituting these values into our previous formula give the following annual costs:

<i>Annual Cost in Dollars at 40% Load Factor and 20% Loss Factor</i>	
<i>Cost Factor</i>	
Copper Loss @ 100% Load	
Investment Charge	\$25.00/kw of loss
Production Cost	\$13.25/kw of loss
Core Loss	
Investment Charge	\$35.00/kw of loss
Production Cost	\$48.30/kw of loss
Regulation @ 0.8 P. F. @ 100% Load	\$1.075/kva/% Regulation
Exciting Current	\$.027/kva/% Exciting Current
Initial Investment	15% of Initial Cost

Now that all of the annual costs have been determined we may now apply them to any transformer on our system. This will give us the relative merit of any transformer design, and give us a tool for obtaining the unit which will provide the most economical operation throughout the transformer's life.

Here is a typical transformer design which is presently available.

We will call it *Design A*.

25 kva	1φ	4800 volts
Copper Loss	=	373 watts
Core Loss	=	107 watts
Product of Losses	=	39,900
Loss Ratio	=	3.5
% Regulation @ 0.8 P. F.	=	2.2
% Exciting Current	=	1.45
Initial Cost	=	\$300

Using the previously developed cost data, Total Annual Cost at 100% load is \$75.05 (See Table I). Since transformers are not always loaded to exactly 100%, these costs should be figured annually for a typical life cycle of a transformer. Then by using a present worth factor (assume 6½%), all of the future costs may be brought back to today's worth. If our transformer

load cycle starts at 75% and grows at 8% per year until loaded to 150%, and the costs are figured annually for this load cycle, the present worth of Total Annual Costs is \$597. (See Table II.)

Loss Ratio Comparison of Designs

At this point it is easy to ask oneself how these annual costs could be lowered. As was pointed out before, some companies have already provided at least part of the answer. This was to change the loss ratio and in some cases lower total losses. Of course this may cost us more initially, but the operating costs may more than make up for the additional first cost.

This can be shown quite easily if we assume two more designs and calculate present worth of the Total Annual Costs the same as we did for Design A. These two theoretical designs are:

Design B

25 kva	1φ	4800 volts
Copper Loss	=	285 watts
Core Loss	=	140 watts
Product of Losses	=	39,900
Loss Ratio	=	2.03
% Regulation @ 0.8 P. F.	=	1.6
% Exciting Current	=	1.6
Initial Cost	=	\$310

Design C

25 kva	1φ	4800 volts
Copper Loss	=	249 watts
Core Loss	=	160 watts
Product of Losses	=	39,900
Loss Ratio	=	1.55
% Regulation @ 0.8 P. F.	=	1.4
% Exciting Current	=	1.6
Initial Cost	=	\$320

While these are theoretical designs, they follow a pattern to which most manufacturers subscribe. That is, by keeping the Product of Losses constant the cost picture will be the most favorable. While there are many variables in costing a transformer, most companies feel that the Product of Losses is the most significant of all the factors. That by keeping the Product of Losses constant we are able to come up with more realistic and economical answers.

Cost Summary of Different Designs

The present worth of the Total Annual Costs for the three designs are as follows:

<i>Design</i>	<i>Present Worth of Total Annual Cost</i>
A	\$597
B	\$587
C	\$594

These costs have considered only 80% power factor and 20% loss factor. If other conditions are existing on your system, you will use the appropriate values.

Let us consider what happens to these costs if the load factor goes up to 50% or 60% with loss factor up to 31% and 42%.

Recalculating Total Annual Costs for these new loss factors give this picture:

Fig. 1 shows that Design B is more economical than Design A as long as the loss factor exceeds about 12%. Also Design C is more economical than Design A above a loss factor of about 18%. These costs can be recalculated for any power factor that may exist on any system.

Present Worth of Total Annual Cost

<i>Design</i>	<i>40% load factor (20% loss factor)</i>	<i>50% load factor (31% loss factor)</i>	<i>60% load factor (42% loss factor)</i>
A	\$597	\$650	\$702
B	\$587 (1.7%)	\$625 (3.8%)	\$665 (5.3%)
C	\$594 (.5%)	\$630 (3.1%)	\$663 (5.6%)

% savings of Design B and C over Design A shown in parenthesis.

Fig. 1—Present worth of total annual cost for designs A, B, and C at 80 percent power factor.

Fig. 2 shows the percent savings of Designs B & C over Design A. Notice that for a loss factor of over 18% Design C has a decided advantage.

Conclusions

The utility industry is justifiably proud of its record of keeping the cost of electricity down even though equipment and fuel costs have risen constantly. It is imperative, if this trend is to continue, that we take advantage of every opportunity to reduce operating costs and purchase only equipment that will allow us to operate efficiently and economically.

The only accurate way is a careful analysis of costs. Let us look at our distribution transformer costs and loads and see whether any changes are warranted. Then let us each make our position known so transformer manufacturers will know what design is best for our industry.

Since the percent saving per transformer is relatively small, it is extremely important that the cost and load factors are accurate. A good place to start is the development of accurate load and loss factors. Very few companies have reliable data on these, and an "educated" guess can lead only in one direction—inaccuracy.

It would be a chaotic situation for manufacturers if each of us came up with a different "optimum design" and demanded that they build this exact unit for us. What is needed is for each of us to study this problem, and then co-operatively select one new design that will be the very best compromise for all of us.

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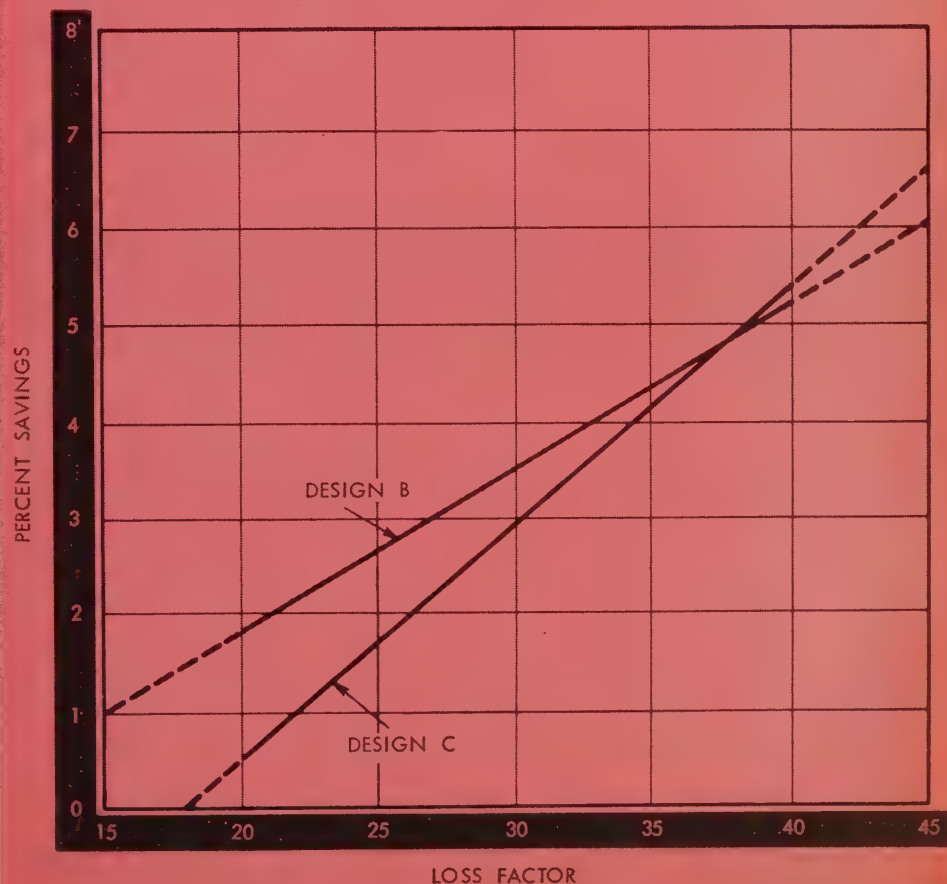
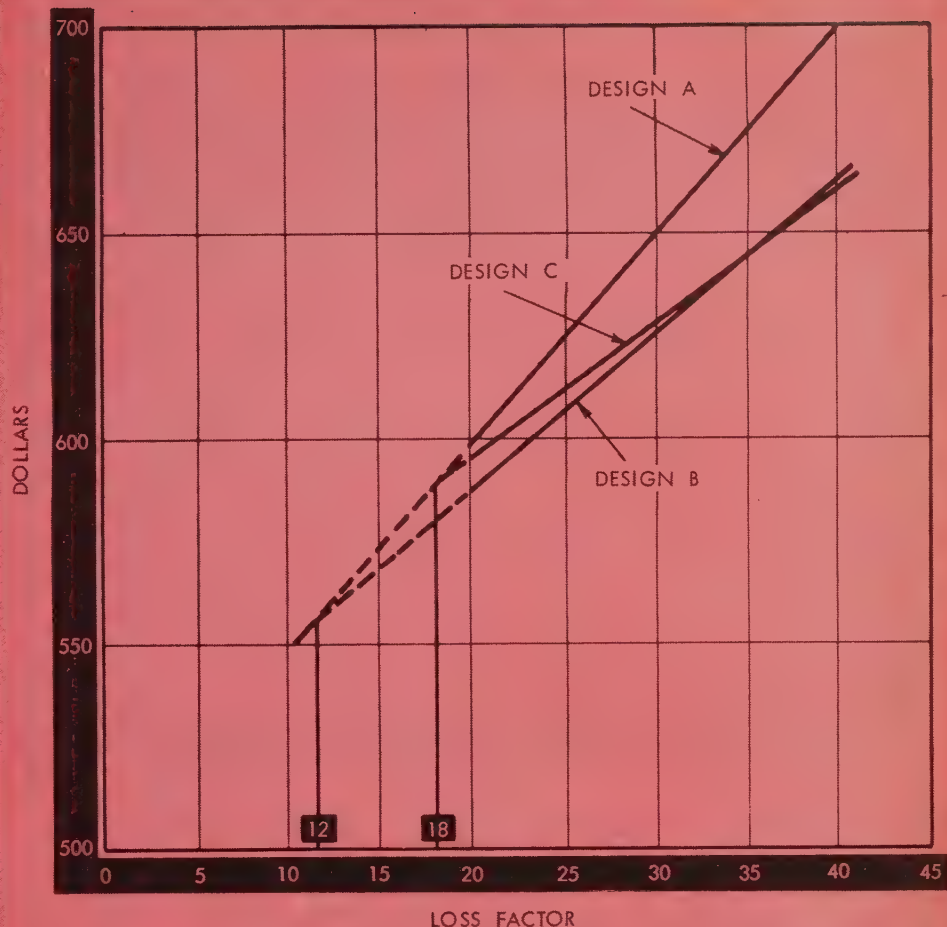


Fig. 2—Percent savings in total annual cost for designs B and C over design A at 80 percent power factor.

Appendix 1

Definitions

1. **Load Factor** = $\frac{\text{Average Load}}{\text{Peak Load}}$
figured on an annual peak load and annual average load for any given transformer. This may also be figured as $\frac{\text{Annual kwh}}{\text{Peak Load} \times 8760 \text{ hrs.}}$

where the kwh are the total kwh's flowing thru the transformer in one year. See Fig. 3.

2. **Loss Factor** = $\frac{\text{Average Loss}}{\text{Peak Loss}}$
figured on an annual peak loss and annual average loss for any given transformer. This affects the copper loss factors.

One method of developing this is to obtain an average kva daily load curve for several times during a year. Squaring these curves give the effect of the loss changes during the year. See Fig. 4.

3. **Load Power Factor**—This is the power factor at the secondary terminals of the transformer at peak load.

4. **Present Worth Factor**—This factor converts any costs spent in the future to their value today. It may be thought of as the discount factor which will convert the spending of a dollar in x years from now to its present value. The percent value used for the present worth factor is the utilities average cost of money.

5. **Annual Fixed Charge Rate**—This factor is readily available for almost any company. Usually it factors in such things as return on investment, tax payments, depreciation values etc.

6. **Value of Net Increase in Revenue**—This value should be the lowest bracket ϕ kwh rate less the production and transportation cost of this energy.

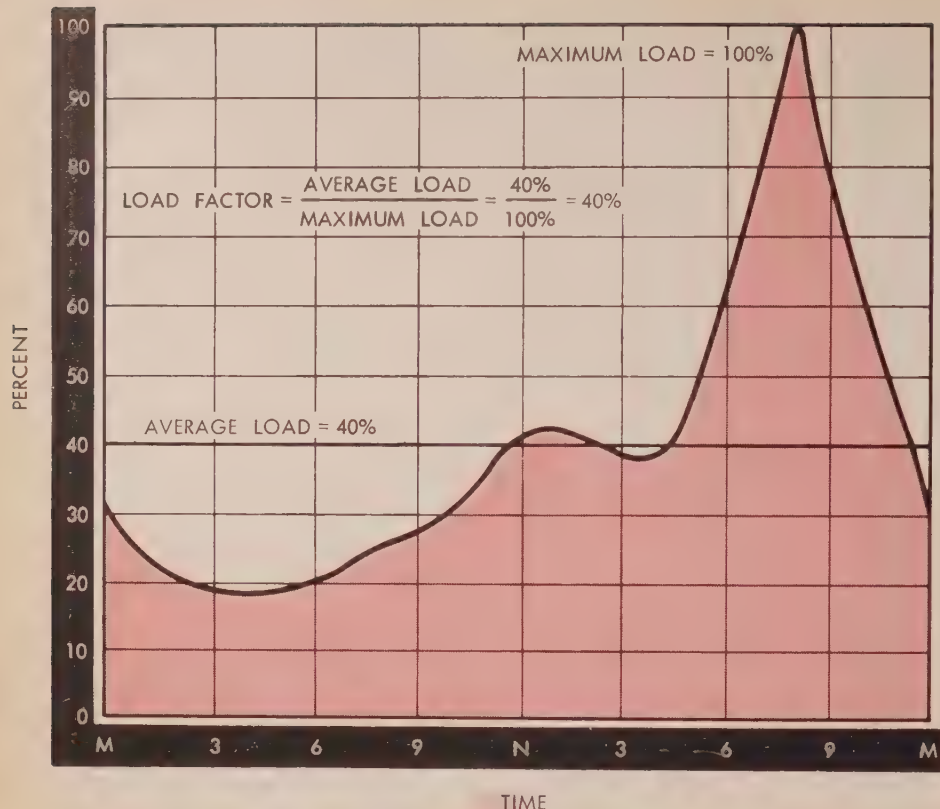
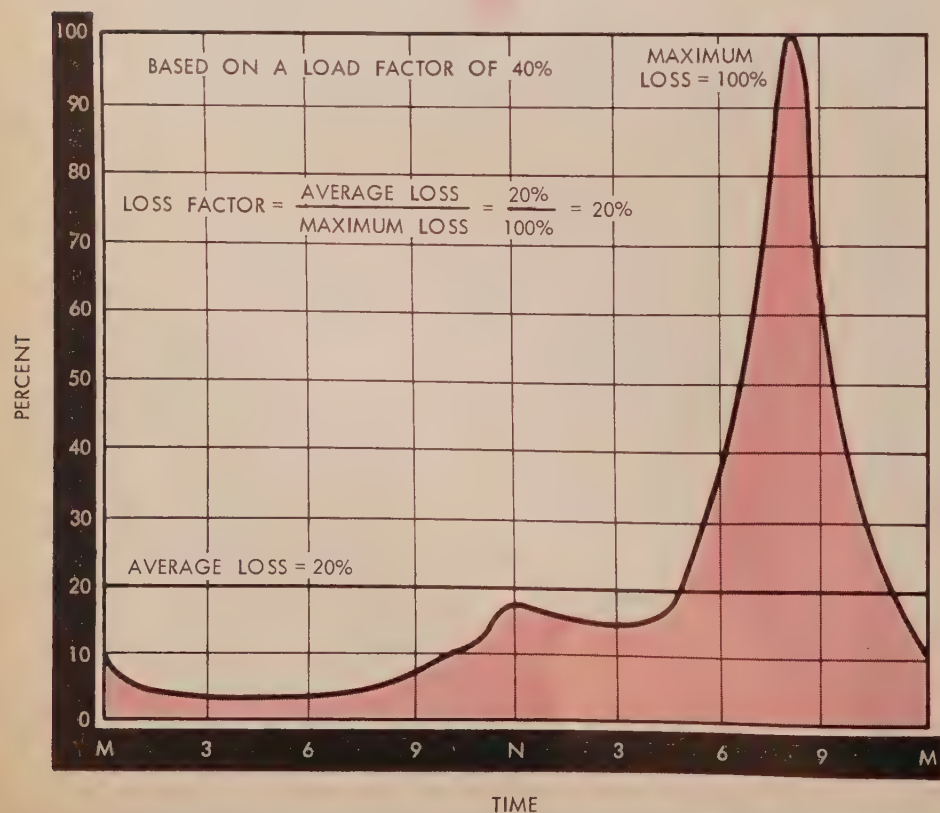


Fig. 3—Load cycle for 40 percent load factor.

Fig. 4—Loss cycle for 20 percent loss factor.



Appendix 2

Formula

1. Annual Cost of Copper Loss (Investment Charge) = $L (F) (P^2)$
2. Annual Cost of Copper Loss (Production Cost) = $[B (8760 \text{ hours}) (F) (N) + (O) (F)] P^2$
3. Total Annual Copper Loss = $1 + 2$
4. Annual Cost of Core Loss (Investment Charge) = $M (G)$
5. Annual Cost of Core Loss (Production Cost) = $8760 \text{ hours} (G) (N) + (O) (G)$
6. Total Annual Core Loss = $4 + 5$
7. Annual Cost of Regulation @ .8 P. F. = $4200 (B) (E) (C) (H) (P^2) (R)$ where $C = .8$
8. Annual Cost of Regulation @ 1.0 P. F. = $4200 (B) (E) (C) (I) (P^2) (R)$ where $C = 1.0$
9. Annual Cost of Exciting Current = $J (E) (Q) (D)$
10. Annual Cost of Fixed Charges on Initial Investment = $K (D)$

TABLE 1.

DESIGN A		.8 POWER FACTOR		
LOSS FACTOR →		20%	31%	42%
LOAD FACTOR →		40%	50%	60%
CORE INVESTMENT		\$3.75	\$3.75	\$3.75
LOSS PRODUCTION		5.15	5.15	5.15
EXCITING CURRENT		1.00	1.00	1.00
FIXED CHARGES ON INITIAL INVESTMENT		45.00	45.00	45.00
TOTAL (X)		\$54.90	\$54.90	\$54.90
COPPER INVESTMENT		9.30	9.30	9.30
LOSS* PRODUCTION		4.95	7.70	10.40
REGULATION*		5.90	9.15	12.40
TOTAL (Y)		\$20.15	\$26.15	\$32.10
TOTAL (X) + (Y)		\$75.05	\$81.05	\$87.00
* FIGURED AT A PER UNIT LOAD OF 1.0				

TABLE 2

PRESENT WORTH OF ANNUAL COSTS

DESIGN A

80% POWER FACTOR & 40% LOAD FACTOR

YEAR	0	1	2	3	4	5	6	7	8	9	TOTAL
PER UNIT LOAD**	.75	.81	.875	.945	1.02	1.10	1.19	1.29	1.39	1.50	
TOTAL (X)	54.90	54.90	54.90	54.90	54.90	54.90	54.90	54.90	54.90	54.90	
TOTAL (Y)	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	20.15	
FACTOR 1	.56	.66	.77	.89	1.04	1.21	1.42	1.66	1.94	2.25	
(Y) (FACTOR 1) = Y'	11.28	13.30	15.51	17.93	20.96	24.38	28.61	33.45	39.09	45.34	
X + Y'	66.18	68.20	70.41	72.83	75.86	79.28	83.51	88.35	93.99	100.24	
FACTOR 2	1.0	.94	.88	.83	.78	.73	.685	.64	.60	.57	
(X + Y') (FACTOR 2)	66.18	64.10	61.96	60.45	59.17	57.87	57.20	56.54	56.39	57.14	\$597.00

**USING AN 8%/YEAR INCREASE

FACTOR 1 = PER UNIT LOAD SQUARED

FACTOR 2 = PRESENT WORTH FACTORS AT 6½%

SYSTEM APPLICATION and CONTROL of KILOVARS

By S. H. POLLOCK,
*Principal Engineer,
Kansas City Power & Light Company*

Maintaining high power factor on generators and transmission system, as well as distribution system, results in good regulation during normal condition and provides remaining generators with capacity to pick up var generation of machine in trouble and supplies var requirements of tie lines during emergencies.



SOME years ago there were virtually no capacitors located on distribution circuits. Because some utilities offered a rate premium for high power factor, a few industrial customers found it advantageous to use them. Some utilities also installed rotary condensers at substations, usually for transmission line voltage control. Today, however, nearly every distribution circuit has its complement of capacitors (at least in this area), and their application and control for kilovar generation has evolved into a complicated problem.

A review of reasons for this change reveals three general causes. First, winter peaks of some 20 years ago were caused by heavy lighting loads, substantially at unity power factor. Summer loads around 50 to 60 percent of winter peak, even though at somewhat lower power factor, were well within the capacity of a system that could handle the winter peak. Thus, since capac-

itors cannot reduce the kva of unity power factor loads, one of the main reasons for using capacitors today was then non-existent.

Today, summer peaks are caused by air conditioning and refrigeration equipment, and other appliance motor loads, at substantially less than unity power factor. These items have caused the var load to grow at a greater percentage than the watt load so that power factor for the customer's load at the time of system peak is about 80 percent. Thus, installation of capacitors can make a substantial reduction of up to 20 percent of the peak kva load.

Reactance And Resistance

Formerly power plants were located near the load and a large part of the load was served directly from the power plant bus. When feeders

Editor's Note: This is an adaptation of a paper presented by the author at the 31st annual Engineering Conference of the Missouri Valley Electric Association, April, 1960.

can directly from power plants to the load, resistance and reactance values of the feeder were about equal. Today, power plants are farther from the load and power is brought in over high voltage transmission lines. Even where plants are located close to the load, the amount of power is so great that high voltage transmission is often used to convey bulk power to distribution substations. Today's transmission system, including step-up and step-down transformers at each end, has a reactance value ten or more times as high as the resistance. Thus, increase in the percentage of voltage drop to supply low power factor loads provides a second reason for using capacitors.

Fig. 1 shows voltage drop of typical former and present systems for different power factor loads. The former system is shown as ten 13.8-kv 1/0-copper circuits; the present system is shown as a 161-kv line using 250-mcm conductors with a 60-mva transformer at each end. Impedances of both systems are expressed in percent on a 60 mva base. From the graph it may be seen that as power factor decreases volt-

age drop increases rapidly on the present high-voltage system. Thus it is clear that while kw can be delivered over either system, transmission of vars over the high voltage transmission line is accompanied by excessive voltage drop. The solution, of course, is to generate vars near the load requiring them; this can be done most economically by installation of capacitors on the distribution lines supplied by the step-down transformer.

A third reason is to supply reserve var generation capacity when power is brought in over a tie line. This is discussed in detail on page 65.

A possible fourth factor is an almost annual decrease in price of capacitors, making their applications economical in more situations each year.

Application and Control

The first capacitors applied to a system should be fixed, or unswitched. This is a rather limited quantity and should not exceed the minimum var load during the year. Most systems can use many more capacitors during peak load periods

but some method of control is needed to remove them during periods of light load.

The control may take many forms. Time clocks are popular and are well-suited to industrial loads. Ambient temperature thermostats are ideal where air conditioning is a predominant factor, especially on residential feeders. Voltage relays are good on unregulated circuits, but may have a tendency to hold the capacitor off the line on regulated circuits until the regulator reaches the full boost position. Current relays work fine for normal conditions, but under feeder emergencies have a tendency either to burn up the relay or fail to put the capacitor on, depending on where the relay is located with respect to the failure. Some fault can be found with any method of control. One solution is to use several different methods of control and then no one event can occur that will adversely affect all capacitors at the same time.

To realize full benefit of capacitors, as more and more of them are added, control schemes will need some refining by using com-

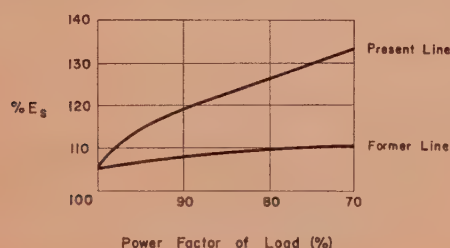
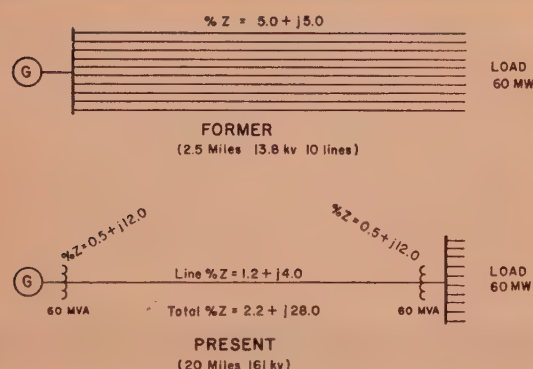


Fig. 1—Sending-end voltage required for two types of lines at various load power factors.

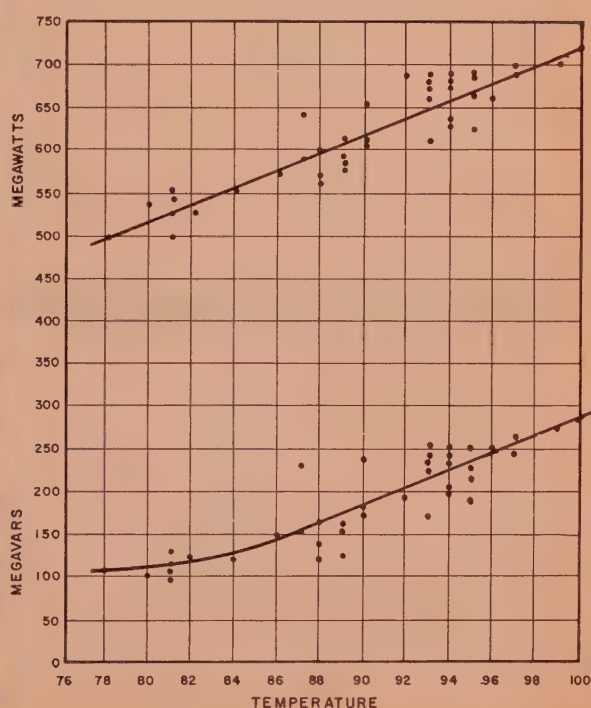


Fig. 2—Peak load versus ambient temperature for July and August 1959, excluding Saturdays and Sundays.

binations of controls mentioned above. For instance, in areas of large commercial loads which include air conditioning, a combination of a thermostat to close capacitors on hot days and a time clock to hold them off during nights and Sundays will give excellent results. Another combination consists of a thermostat or time clock for normal day-to-day operation, and an over-riding voltage relay that will bring the capacitor on in the event of low voltage no matter what the normal relay dictates. This offers particular advantages for systems that depend on transmission lines for generator emergencies in that low voltage will turn on capacitors to help supply var requirements of the transmission line.

By 1959, KCP&L had the following capacitors on its system:

Fixed	83,910 kvar—	24%
Time Clock.....	150,285 kvar—	44%

Thermostat	83,700 kvar—	24%
Current	17,880 kvar—	5%
Voltage	9,900 kvar—	3%
Total	345,675 kvar—	100%

Thermostats are set to put capacitors on at temperatures of 80 and 90 degrees. Fig. 2 shows the mw and mvar system daily peak load versus daily peak temperature for July and August 1959. The curve indicates that system load increases about 1.33 percent of the peak load, or 10,000-kv, for each degree F above a temperature of 80F. Above 90F, when all capacitors are on, var load also increases about 10,000 kvar per degree F. This indicates that the load increase on our system caused by temperature is occurring at a 70 percent PF because watts and vars are increasing at an equal rate. The bend in the mvar curve between 80 and 90 degrees indicates that all thermostatically switched capacitors are not on below 90 degrees, a

condition that is desired to prevent the mvars from reaching zero, or leading, as the temperature load drops. Rapid increase in var load with an increase in temperature shows a definite need for temperature-switched capacitors to compensate for air conditioning load.

Application of capacitors is greatly helped by making watt and var tests on substations and even individual circuits in some instances. An excellent method is to use a recording watt-meter and watt-var auto switch that makes the meter record watts for ten minutes then vars for five minutes. This gives a record on one strip chart of both values so that it is easy to check for the correct number of capacitors and the proper operation of their controls. Fig. 3 shows a strip from such a chart for a 20,000-kva transformer.

Fig. 4 shows a load curve plotted from

Fig. 3—Strip chart from recording watt-meter and watt-var auto switch for a 20,000-kva transformer shows watts for ten minutes then vars for five minutes; readings taken on 95F day.

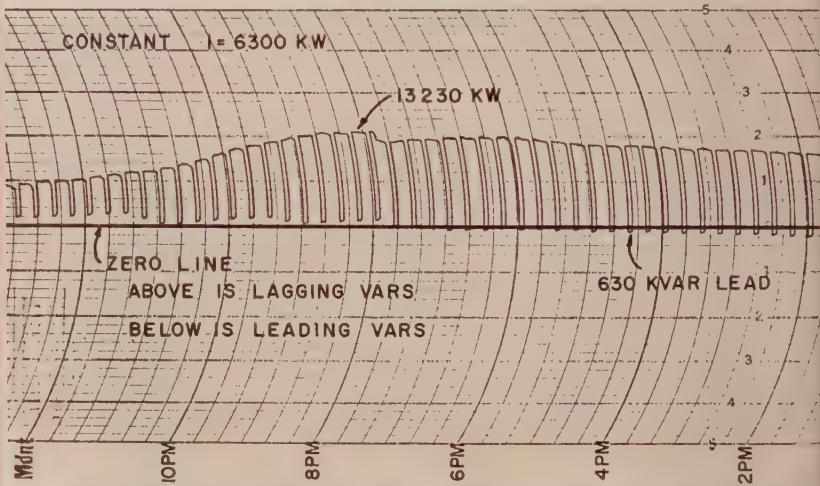
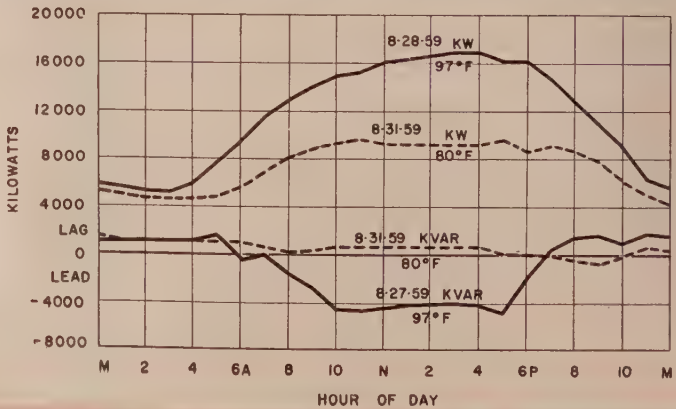


Fig. 4—Load curve plotted from strip chart, as shown in Fig. 3, shows effect of 80 and 97-degree temperatures on watt and var loads.



om such a chart. Kws and kvars
re plotted for a 97-degree day and
n 80-degree day. The kw load was
0 percent less on the cooler day;
however, kvars were slightly lag-
ing on the cool day but leading
during the peak load on the hot
ay. The transformer is 25,000-
va, 161/13-kv, located at a point
n the 161-kv system where we
esired a slightly leading power
actor at peak loads. Measurements
ere made on the 13.8-kv secondary
f the transformer and when var
sses in the transformer are added
o this curve there is still a slightly
leading 161-kv power factor at
eak. The curve shows excellent
ontrol of vars as load varies.

Connected to this transformer are
760-kvar of fixed capacitors, 1500-
var of time-clock switched capaci-
tors, and 9960-kvar of thermostat-
switched capacitors.

Var Requirements of Tie Lines

Requirements of additional vars
when bringing in power over a
transmission tie-line can be shown
by a combination of a machine ca-
pacity diagram and a circle diagram
for the transmission line. The upper
portion of Fig. 5 shows such a tie-
line which brings in power from the
remote generator only when one of
the generators near the load is
taken out of service. In the lower
portion of Fig. 5 two curves show
watt and var capability with all
generators running and with the
largest machine out of service. As-
suming a system load of 750-mw
at 90 percent PF (Point A), it can
be seen that the load cannot be
supplied when the largest machine
is out of service without bringing
in power over the tie line.

Delivery of this tie-line power is
shown on the Fig. 5 graph by

superimposing a circle diagram on
the generator capacity diagram. Axis
for the circle diagram is lo-
cated so that the point where the
line is delivering zero mw is above
load point A; this represents opera-
tion of the tie-line when all ma-
chines are running. By swinging an
arc to the left from load point A,
using the center of the circle dia-
gram as pivot point, a curve is
established that shows both watt
and var loading on generators to
bring in various amounts of power
over the tie-line. In this case it is
clear that while sufficient watts can
be brought in, remaining gener-
ators will be overloaded with vars.

By adding 50 mvar of capacitors
to distribution circuits, at subst-
ation busses, or even on the power
plant bus (all affect the problem in
the same manner), the new load
condition can be shown on the Fig.
5 graph as point B. Constructing a
circle diagram with the zero-mw
point at B, then, produces an arc
which falls within both watt and
var capabilities of the remaining
machines. Circle diagrams in this
figure clearly illustrate vars re-
quired from remaining machines
when power is brought in over the
tie-line.

This form of diagram can be
drawn for any station to determine
capacitors needed to bring in power
over a transmission line during
emergencies.

Network Analyzer Studies

Network analyzer studies also
show how var loading increases on
generators when power is brought
in over a tie-line. Two such studies
made by KCP&L are described.
However, it should be pointed out
that these are studies only and the
system has never been operated in
this manner.

Study 20 (Fig. 6) shows a normal
system with all generators operat-
ing and no power transfer over the
tie-lines. All loads were put on the
board at 90 percent PF as the com-
pany corrects to at least this power
factor to reduce losses and loading
on equipment. Capacitors added to
the system at various points, total-
ing 111 mvar, are shown by the
symbols on study 20. Values and
locations were determined by the
board study to be best for most of
the emergencies that might be ex-
pected on the system. Note that

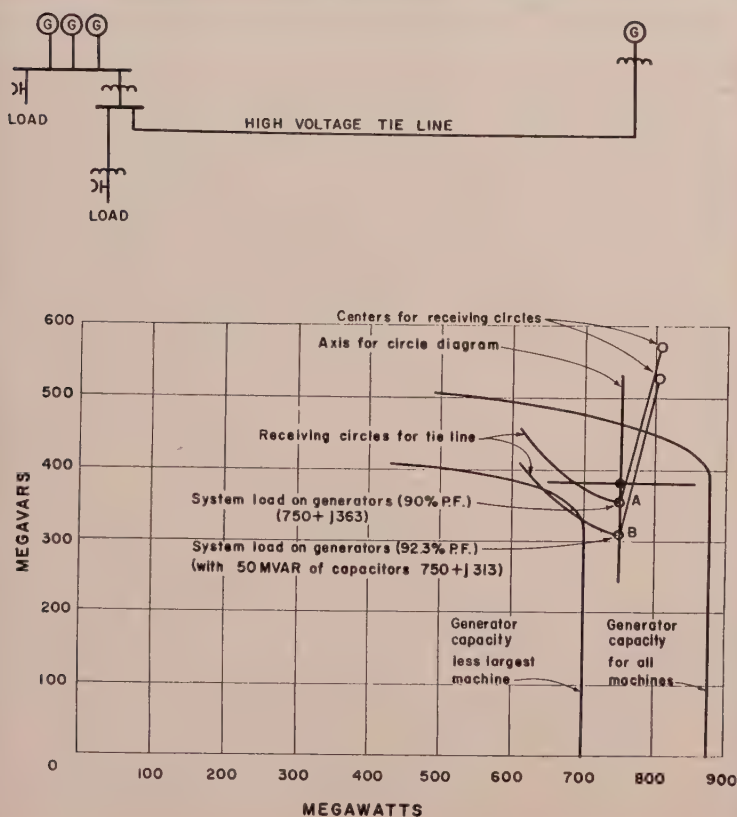


Fig. 5—Effect on generators of bringing power in over a tie line such as shown at the top.

most of the capacitors are located in the lower part of the diagram, with Sub 23 actually operating at a slightly leading power factor.

Study 28 shows the same load and capacitor conditions but with the largest system generator at Station M out of service. Power is being brought in over four tie-lines from St. Louis, St. Joseph, Kansas City, Kansas, and Sunflower. Of the 176 mw generated by Station M, 140 mw is now being brought in by the four tie-lines and 36 mw has been picked up by the generators still on the line. Note how these operating generators have had to pick up vars. Station H₂, for example, has dropped 3 mw in load but has picked up 57 mvar. Average power factor of all generators was

94.1 percent under normal conditions in Study 20 but it dropped to 90.7 percent in Study 28 when power was brought in over the tie-lines.

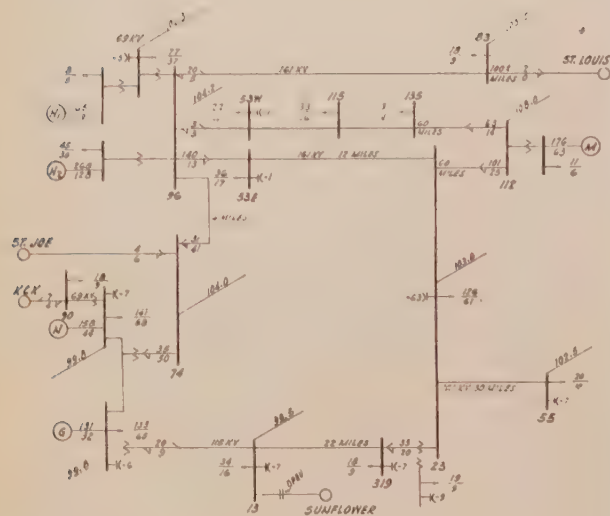
Table I gives load and power factor on the various generators and

TABLE I

	STUDY 20			STUDY 28		
	MW	MVAR	PF	MW	MVAR	PF
H ₁	65	19	96.0	65	32	89.7
H ₂	268	128	90.2	265	185	82.0
N.....	158	44	96.3	183	47	96.9
G.....	131	32	97.1	140	40	96.1
M.....	176	63	94.1	0	0	—
Total generation.....	798	286	94.1	653	304	90.7
St. Louis.....	—2	0	—	46	—10	—
St. Joseph.....	4	6	—	53	—20	—
Kansas City, Kansas.....	—7	4	—	32	—1	—
Sunflower.....		open		9	4	—
Total Ties.....	—5	10	—	140	—27	—
Gross Total.....	793	296	93.7	793	277	94.4

tie-lines for both studies.

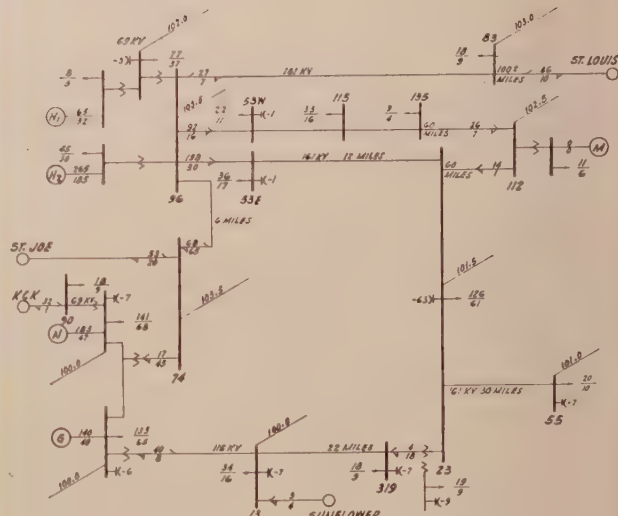
Note that gross total mvar dropped 19 mvar from 296 mvar to 277 mvar when station M was shut down. Referring to Study 20, it can be seen that var loss in station M (Continued on page 105)



	MW	MVAR	PF
GENERATION	798	286	94.1
TIE LINES	-5	10	-
TOTAL	793	296	93.7

LOAD 768 382 89.5
CAPACITORS

STUDY NO. 20



	MW	MVAR	PF
GENERATION	653	304	90.7
TIE LINES	140	-27	-
TOTAL	793	277	94.4

LOAD 768 382 89.5
CAPACITORS

STUDY NO. 28

Fig. 6—(a) left, network analyzer study—20 shows a normal system with all generators running and no power transfer over tie-lines, and using 90 PF; (b) right, study 28, shows the same load and capacitor conditions but with the largest system generator out of service, and power being brought in over four tie-lines.

WIRE SHIELDING 230-Kv LINE CARRIES POWER TO ISOLATED AREA

WHEN PRUDENT ENGINEERING indicated that the route of the new three-company 230-kv transmission line connecting power plants in the Hells Canyon reach of Snake River with northern Idaho and eastern Washington should pass through the remote and picturesque Imnaha Valley, there was also devised a unique method employing an energized shield wire for supplying electric service to ranches and residences within the valley.

For 50 miles in the Hells Canyon section the turbulent Snake River is roughly paralleled on the Oregon side by the Imnaha River. This small but beautiful river has its headwaters in the forested and snow-clad Wallowa Mountains of eastern Oregon and flows first east to within seven miles of the Snake River in the Hells Canyon, then suddenly turns north and does not join the larger river for another 50 miles. Confluence finally occurs at a point close to where the Salmon River also enters the Snake River from the opposite or Idaho side. Thus, the Imnaha Valley forms a natural north-and-south by-pass route, having an existing access-road system around North America's deepest gorge, which is without roads or a good place to build any.

The Imnaha cattle and sheep ranchers, who occupy about 30 miles of this narrow valley, welcomed the survey crews for the 230-kv line and indicated that they had long hoped for the opportunity to use central-station electric service to replace their small individual

plants. Prior to this time, because of the remoteness of this community from a possible source of distribution power, it had not been economically feasible to serve it.

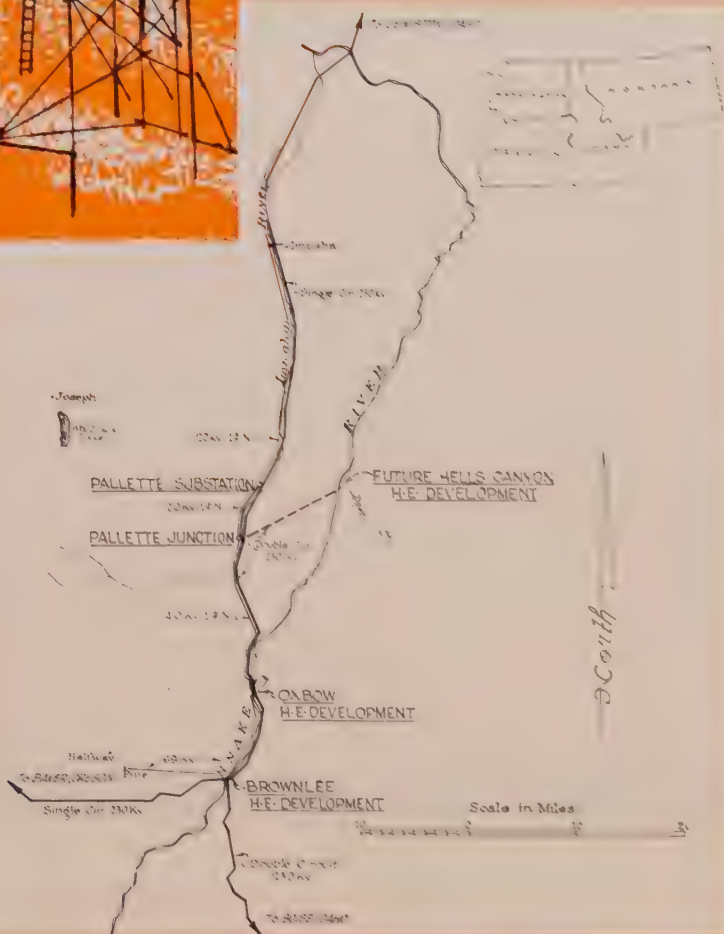
It was determined in the light of new distribution developments in higher primary voltages that the most economical means of supplying service to these ranchers and other residents, about 50 in all, would be sought and service made available if possible. The routing

Idaho Power energizes 230-kv transmission-line shield wire for 25 miles at 40 kv to ground to provide service for ranches and small community along transmission right-of-way.

By D. L. ANDREWS,
Distribution Studies Engineer, and

P. A. OAKES,
System Analysis Engineer,
Idaho Power Company

Fig. 1—Routing and general location of circuits involved in Idaho Power's unique installation utilizing energized 230-kv transmission-line shield wire to provide service for ranches and small community along transmission right-of-way. ➡



and general location of the circuits involved are shown in Fig. 1.

Several Plans Investigated

Several different primary voltages for distribution systems supplied from various possible sources were investigated. Bringing power into the valley separately over a 25-kv or 34.5-kv distribution line fed from either the Oxbow Power Plant area or the town of Joseph, Oregon, each involved about 20

miles of line before the first customer would be reached. The capital investment for each of these plans ranged from \$4300 to \$6700 per customer. These costs were considered to be too high and a plan to step down single phase only from the 230-kv transmission line promised to be even higher.

It was finally concluded that the most economical distribution plant for within the valley would be a single-phase, vertically-constructed, 20-kv line which would also carry the local telephone. This telephone

point 45 miles away within the Imnaha Valley where an autotransformer substation would step the voltage down to the 20-kv distribution. The shield wire input energy would be obtained from one phase of the 69-kv local service supply at the Oxbow Power Plant. Since the steel-tower section of the transmission line carries only one shield wire, the return path would need to be through the earth.

The cost of the complete system using the energized-shield-wire scheme is estimated to be about

230-kv steel towers, averaging approximately 130 feet in height, with the highest phase 26.5 feet below the shield. For another five miles, both shield wires of "H"-frame-type construction are used to transmit power, one shield wire carrying the 40-kv service to Palette substation and the other serving as one branch of the 20-kv single-phase distribution. The "H"-frame construction utilizes mostly 70- or 75-ft poles with 19.5 feet between phases and approximately 16-ft vertical separation between shields and phases.

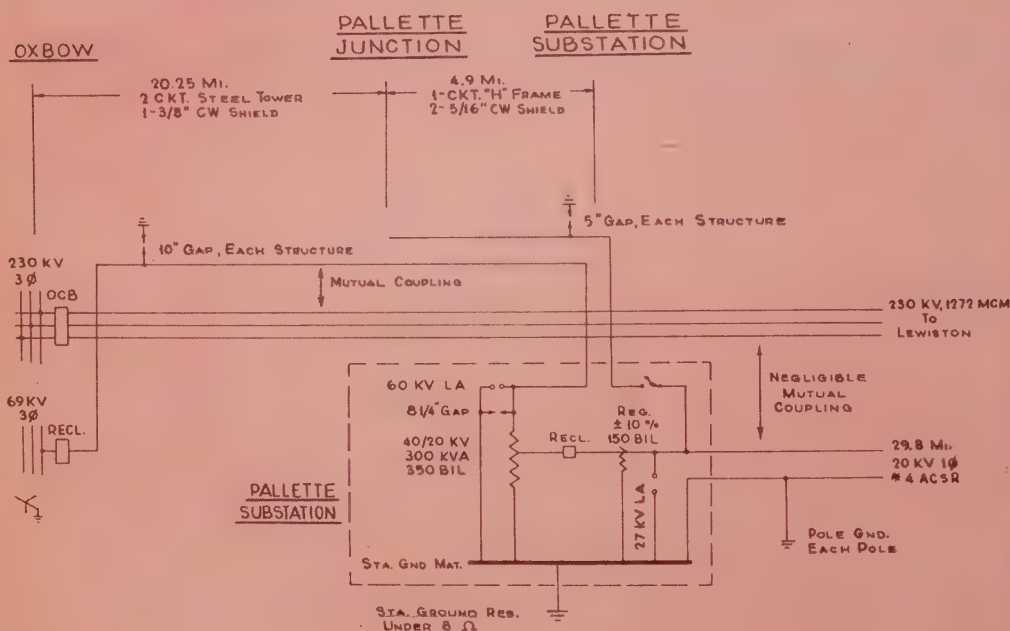


Fig. 2—Essential electrical details of the 20-kv and 40-kv circuits for Idaho Power's shield-wire power-supply system for isolated area.

circuit was already in use and needed to be converted from ground return to a full metallic circuit which could be transposed to minimize inductive interference. It was desired to provide a total capacity of about 300 kw even though load growth would probably not reach this value for several years. Initial diversified demand for 50 customers was taken to be about 100 kw or two kw per customer.

To solve the problem of power source the unique plan was devised to energize the 230-kv transmission line's Copperweld shield wire at 40-kv to ground, from the substation near the Oxbow Plant to a

\$3600 per customer for 50 customers. This cost drops to \$3000 each when credit is given for the pole plant which is being provided for the telephone system.

Technical Considerations

Because of the proximity of the 230-kv line to the 40-kv and 20-kv circuits, many questions arose during the early planning stages concerning the effects of electrostatically- and electromagnetically-induced voltages. Another question was the earth-return of the 40-kv circuit.

For 20 miles, the 40-kv shield wire rides atop the double-circuit

The 27-mile balance of the 20-kv distribution circuit roughly parallels the 230-kv line, crossing under it several times but separated far enough that induction is negligible. Fig. 2 shows the essential electrical details of the 20-kv and 40-kv circuits.

Calculation of the inductive coupling was fairly routine, being based upon well-known formulas and tables. Calculation of the electrostatic coupling, on the other hand, proved tedious because it required inversion of a fourth-order matrix.

The question arose whether the electrostatic induction would be

severe enough under light-load conditions, or with the 20-kv feeder switch open, to cause damaging voltage to substation equipment when the 40-kv supply recloser at Oxbow opened. Calculation showed that the maximum electrostatically-induced voltage would be less than the rated operating voltage under all conditions and that transformer exciting susceptance would be less than one-tenth the magnitude of shield capacitive susceptance to ground, so that problems due to ferro-resonance should not develop.

Electromagnetic induction due to ground-fault currents in the 230-kv circuit is more severe. Calculation

tion. A 30-kv arrester giving the same percentage seal-off voltage as the high-side arrester is now being considered for the 20-kv side.

The 20-kv-side transformer and regulator BIL and arrester coordination are now being checked to see if a 30-kv arrester will provide sufficient impulse protection. The 20-kv distribution transformers are 150-kv BIL and will all be protected by 27-kv arresters because that is an optimum size for the transformer BIL. Also, it is not expected that sparkover voltages will be carried to the distribution transformers under conditions likely to produce high induced voltage.

tween energized shield and a 230-kv phase, the gaps should arc over and thus protect the substation equipment since the 60-cycle sparkover of a 10-inch gap is in the order of 100-kv crest.

Because there is no metallic neutral return for the 40-kv circuit, load current must flow to earth through the station grounding resistance. The 400 distribution-pole grounds are in parallel with the station ground connection and normally divert some of the return load current away from the station ground but, due to their impedance, most of the current is expected to flow through the station grounding

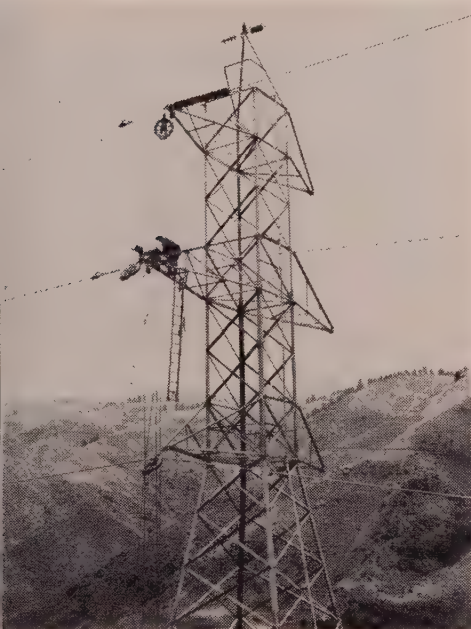


Fig. 3—Tower on Oxbow-Palette Junction section showing terrain and treatment of shield wire on steel tower section. Gap is to top of post insulator.



Fig. 4—Structure on H-frame section of line showing treatment of 20-kv and 40-kv shield wires and gaps.

showed that ground faults under some conditions would induce sufficient current into the 40-kv circuit to cause tripping of the 40-kv recloser at Oxbow. Under these conditions, voltage at the substations would rise to approximately 150 percent before tripping. It was for this reason that 350-kv transformer BIL and 60-kv arrester were chosen for the 40-kv side of the station. Normally, a lower BIL and arrester would have been chosen.

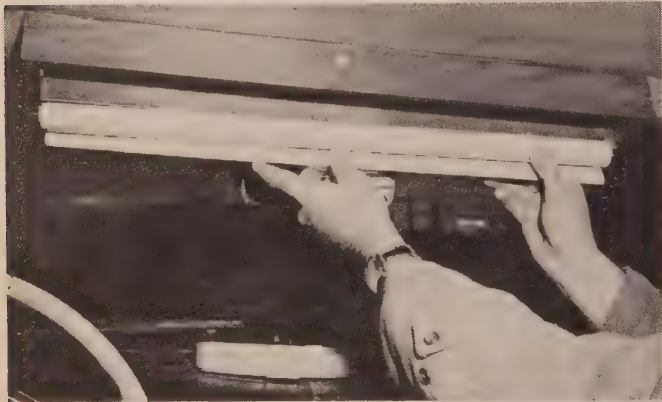
The 20-kv side substation arrester has been selected as 27-kv and, as such, is not quite high enough to insure seal-off in the presence of the maximum induc-

Shield Wire Gapped To Ground

The energized shield wire is gapped to the tower ground at every tower. The 40-kv gap spacing is ten inches and the 20-kv gap spacing is five inches. Details of gap treatment are shown in Figs. 3 and 4. In cases of direct lightning stroke to the energized shield, or impulse voltage sufficient to produce gap breakdown, the shield would become effectively grounded. The BIL of the shield is not considered high enough in comparison to that of the 230-kv circuit to materially detract from its primary purpose of shielding the 230-kv line. In case of contact be-

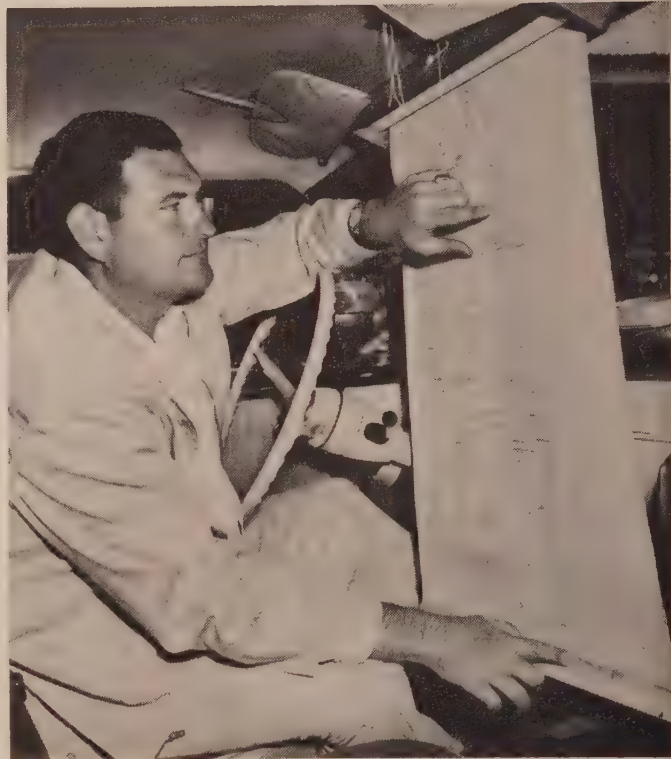
resistance. For design purposes, it was assumed that all current would flow through the station ground resistance. On this basis, it was determined that if the station ground resistance was held under eight ohms no trouble would be experienced due to heating and drying of the earth surrounding the ground connection and causing progressive failures of earth connection at the substation and then at pole grounds. Station ground resistances under eight ohms are as a rule easily obtained in normal practice but it is something which will require checking.

WINDOW SHADE ROLLER MAKES OPERATING MAPS QUICKLY AVAILABLE



Area operating map is inserted or removed as simply as a window shade. Note plastic puller (under author's left thumb) which prevents map from flopping as a window shade sometimes does.

All Author Watters has to do to note a transmission line, line switch, or substation in his area, is to pull down his window-shade type map.



By Jack Watters, Area Operator
Consumers Power Company
Flint, Michigan

A common window shade roller has helped make map reading in cars a much easier process than it was using the old fold-unfold method. As changes in the area occur they are noted on the window shade map (which is a copy of a master in the office). The original copy is kept up-to-date and new copies are used in the cars as soon as enough changes occur.

Size of the one-line diagram maps used in Flint area operating cars, was determined by space available in the cars. The map case is installed directly above the windshield and in the center of the car. Since there is a small cross-member located in most cars directly above the windshield, the case can be mounted there by two sheet-metal screws. Ample room remains for the sunvisors over the case.

Case dimensions are 26½ in. long by 21½ in. square. The case was made of ¼ in. plywood for the sides and top, with ¾ in. plywood for the end. Mounted in each end

of the case are standard window shade roller hangers. A regular window shade roller was cut to fit between hangers. The map then was taped to the roller with Scotch tape, as this seemed to be the easiest and quickest method.

The bottom of the map was rolled twice over a standard window shade slat and taped into place. This was placed on the map to prevent it from tearing when pulled down. To prevent the map from rolling up into the case and flop-

ping until it unwound, a plastic window shade puller was put on the bottom. When the map is raised, the plastic puller will bind the case and roller which prevents it from flopping. It also makes a good handle with which to pull the map down. In the Flint Division area the map gives a quick and clear picture of any lines or switches which might be designated for transferring or repair. When the division dispatcher calls on two-way radio and gives a switching order, it is very easy to reach up and pull the map down in order to see what switches, lines or substations are to be investigated.

CREW MANNING BOARD INCREASES LINE DEPARTMENT PRODUCTIVITY

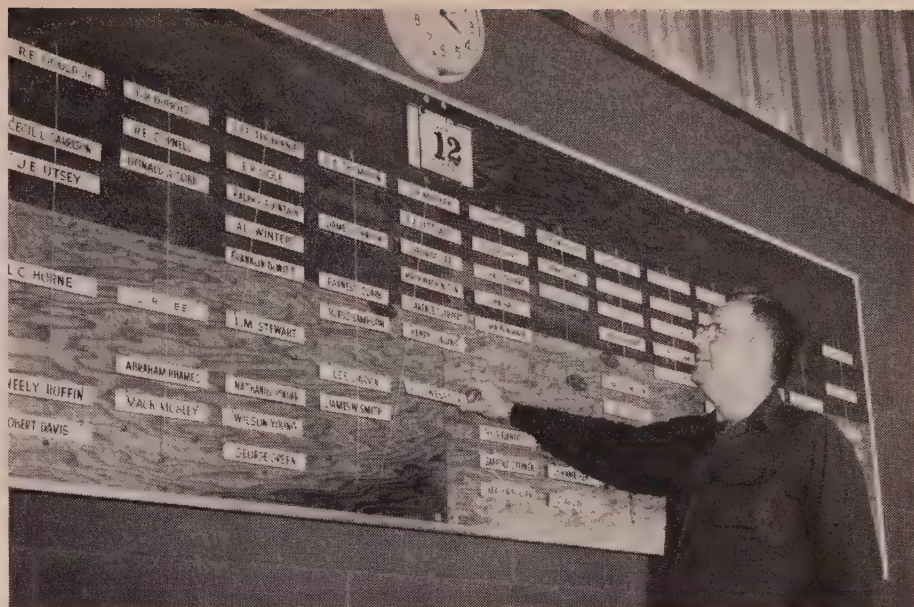
By Daryl E. Gaiennie
Asst. Supt. of Transmission & Distribution
Savannah Electric and Power Co.

The Savannah Electric & Power Co. has effected an average saving

of 25 minutes per crew per day for nine crews, by use of a crew manning board combined with rescheduling of storeroom personnel to load trucks before Line Department

starting time. It has also considerably increased the Line Department productivity. This eliminates the necessity of assigning men by verbal order, as each employee checks the board before reporting to his assigned crew.

The board lists all men under their respective foremen or particular section for the current day. The general line foreman arranges men by crews and special assignment prior to scheduled work time after having received information from night clerks, relative to sickness, emergencies necessitating absence, and prearranged vacations. It is his responsibility to have enough of the proper classifications on each truck and in each section. The manning board system has been used for more than two years.



Crew manning board saves 25 minutes per crew per day for nine crews. C. F. Branch, general line foreman is shown correcting the board.

HOMEMADE TOOL CUTS GASKET-REMOVING TIME

By C. P. Stokes
Substation Mechanic "A"
Indiana & Michigan Electric Co.

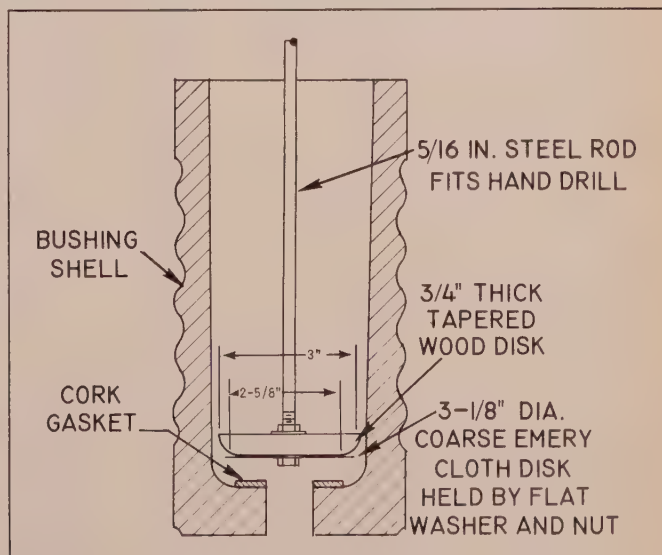
A simple homemade attachment for a portable hand drill has reduced by about 30 minutes the time required to remove gaskets from oil-filled bushings. It also prevents injuries because it eliminates the need to work with hands inside the porcelain.

Some of the old style 37-kv type of oil-filled bushings have a cork

gasket sealed with glyptal inside the bottom of the lower porcelain shell. These are a nuisance to remove during rebuilding, and because of the awkward location took considerable time to scrape out with a sharp hand tool. Then the surface had to be cleaned up with emery cloth. This usually took about 40 minutes, providing the porcelain didn't break or injure the workman doing the job.

Now a homemade attachment for

the portable hand drill is used to safely and easily grind out the gasket in less than 10 minutes. It can readily be assembled at practically no cost from miscellaneous scrap wood and hardware. The coarse emery cloth provides an adequate abrasive surface to grind out the gasket. The mounting nut and washer that hold it in place protrude through the hole in the bottom of the bushing shell with safe clearance during grinding.



Grinding attachment is shown inserted into lower porcelain of bushing—ready to grind out old gasket at bottom. This simple tool avoids need to work with hands inside the porcelain, thus preventing injuries and saving time.

Author Stokes prepares to grind out bushing gasket with his homemade attachment for portable hand drill.

PCEA Hears Pleas for Bigger Utility Role In Political Action, Aid-to-Education

Discussion went considerably beyond the theme at the 1960 annual convention of the Pacific Coast Electrical Association in Las Vegas, Nevada, on May 16, 17 and 18.

The theme—"Stakeholders Speak Out"—was decided upon to encourage consideration not only of various phases of the electric industry but also numerous matters of great importance to the general public. These matters included action by businessmen in the political field, the duty of utility companies to help support higher education, the urgent need of informational programs to help combat government ownership.

But recent emergencies in the cold war prompted stakeholders to widen discussions to include Russia, the Summit Conference and other global problems.

The electric power business was urged by Sherman R. Knapp, president of the Connecticut Light and Power Company, to "speak louder locally to be heard nationally" and thus increase national stature and public understanding.

Mr. Knapp declared that the accomplishments of utilities have been taken for granted and added: "The electric company in its own community enjoys great prestige, but the power industry as a whole is less than some of its parts."

"No family or factory in our service areas has gone hungry for electric power. When community growth demanded more power it was there. In many cases it took years of planning, financing and construction to have the power when the thumb pressed the button."

The need for informational programs for utility employees, customers, investors and the general public was stressed by EEI's Edwin Vennard. The purpose, he explained, is to correct the lack of information responsible for the public sentiment that permits government ownership.

Mr. Vennard outlined four courses which the Institute has made available or has in prepara-

tion to inform employees of facts about America and the electric power industry. The first course covers fundamental facts about the American economic system and how it works. The second is about American freedom—how we can keep it or lose it. Another explains the fundamentals of the electric utility industry and the fourth deals with the problem of government operation of the power business.

Gros: Face USSR Unafraid

Because of the international crisis—the Soviet's uproar over the U-2 incident and Khrushchev torpedoing the Summit Conference—Robert R. Gros, vice-president of Pacific Gas and Electric Company, abandoned his scheduled address on "Toughening Up For the Title Bout" and presented a new one covering and reflecting the momentous world events.

Adapting the convention theme—"Stakeholders Speak Out"—to the world scene, he declared:

"We are playing for the biggest of all stakes. Losing the game would be irreparable, because the stakes are sheer survival. The choice may be between the quick and the dead."

Mr. Gros painted a portrait of Khrushchev based on a day and a half spent with him last fall as official representative of Mayor George Christopher during the Russian leader's visit to San Francisco. He termed Khrushchev "volatile, shrewd, amazingly knowledgeable regarding the United States, cocky, cruel, a wily fighter, passionately dedicated to his Communistic system." And he cautioned that "we dare not underestimate our enemy."

"America should quit quaking in its boots every time Khrushchev bellows. We should tote up the American balance sheet, recognizing our weaknesses and, of course, doing something about them. But we also should take account of the magnificent strength of America—militarily, industrially, morally. Calm confidence can come only to

Association business included the election of Harry F. "Pop" Hartzell



H. F. Hartzell

of San Francisco as president of PCEA to succeed Charles A. Wikle of Los Angeles. Hartzell, who is chairman of the board of Maydwell and Hartzell, Inc., engineering repre-

sentatives, began his electrical career with Westinghouse in 1908 and was transferred from New York to San Francisco in 1914. He left Westinghouse in 1915 and eight years later he joined with the late Charles A. Maydwell to organize the firm he now heads.

The convention attracted 900 men and women representing California, Nevada, Arizona, Hawaii.

men and women not afraid to face might, nor themselves to possess might. With that spirit America will win out."

U. S. Education Needs Help

Frank H. Sparks, president of the Council for Financial Aid to Education, sounded this appeal:

"American education needs help, needs it badly now, will need it even more in 1970 and business must contribute additional help if we are to maintain our position of world leadership . . .

Mr. Sparks coupled his appeal with the charge that utilities as an industry have lagged in their voluntary support of education as compared with other industries. He reported that a recent study of the aid programs of 532 leading concerns, showed utilities ranked 21st among 24 industry groups in the percentage of net profits before taxes contributed to the support of higher education. He said:

"Higher education will need at least two billion dollars in voluntary contributions by 1960. Last year the gifts from all sources amounted to more than 900 million dollars. To double this amount by 1970 means that business will have to do very much more than it is now—or more companies will have to do what the leaders are now doing. This applies particularly to utility companies."

BY ANY COMPARISON, WESTINGHOUSE EXCLUSIVE DISTRIBUTION VOLTAGE REGULATOR CUTS COSTS . . . REDUCES 'INVENTORY' . . . STEPS UP SYSTEM PERFORMANCE. Far and away the greatest area of savings to you is in the initial cost of equipment . . . up to 66% in savings in capital investment alone. A relatively few Unoregs,* at \$150 each in the 1¼-kva size, replace bulky banks of conventional line regulators at many thousands of dollars. A wholly new Westinghouse concept of voltage regulation has now made possible total savings of millions of dollars annually for the nation's electric utilities. These outstanding economies have already been proved on some utility systems.

Because of its small size (21½" high, 12¼" in diameter), Unoreg is whisked up the pole in record time, installs easily on the secondary side of the transformer. And just as easily, it can be moved to other locations for emergencies, spot loads or changing line conditions, without disturbing a single transformer. Unoreg doesn't even have to be installed on the same pole with the transformer. This is a virtual impossibility with either the usual cumbersome regulators or with combination transformer-regulator equipment. Here is ease of handling and flexibility of application you can readily translate into thousands of dollars saved, as you use Unoreg.

No matter where it is, Unoreg can save you money. In stocking, for example, just one model, the 1¼, covers over 400 styles of distribution transformers. This tremendous flexibility is at your command because Unoreg is separate from the transformer, representing savings in inventory of both regulators and transformers.

Unoreg is a truly install-and-forget-it device. Unoreg is a plus or minus 5% buck and boost regulator. It will automatically change from one service to the other. Unoreg is an induction regulator, and its voltage control a static relay . . . both inherently trouble-free.

J-70947

*Trade-Mark

TARTS SAVING YOU MONEY ON THE WAY UP THE POLE

Compare Unoreg with any regulating device. Unoreg provides the very best, most economical reregulation available. Check out these "pluses"—

		COMPARE!				
Chart		First Cost	Installation	Flexibility	Stocking	
 UNOREG CONVENTIONAL	Unoreg	+	+	+	+	
	Conventional Line Regulators	-	-	-	-	
	Tap Changing Under Load Transformers	-	-	-	-	

YOU CAN BE SURE...IF IT'S Westinghouse

TUNE IN WESTINGHOUSE CBS TV-RADIO COVERAGE, PRESIDENTIAL CONVENTIONS, JULY 10-29

English Elect. Co. Equipment Gives PUD Troubles at Priest Rapids Dam Project

Equipment failure and operating difficulties experienced with apparatus supplied by the English Electric Co. are harrasing construction efforts at the Priest Rapids dam project of the Grant County PUD, though completion on schedule (in the Fall of 1961) is still predicted by Grant County officials.

Problems have arisen with transformers and electric generators made by the British firm. Somewhat ironically, American-made transformers are being borrowed by English Electric from a U. S. utility company to fill in for the defective transformers until the original equipment can be repaired.

Here's the story up to the end of June, on the English-made products:

One of the English Electric trans-

formers installed at Priest Rapids dam failed on April 25, 1960. Inspection revealed extensive damage to the winding of one phase of the transformer, and the apparent cause was reported to be "high induced currents in the static shield with resultant deterioration of the solid insulation between high and low voltage windings."

This is how the PUD reports the efforts to overcome the difficulties:

"English Electric has shipped this transformer back to England for disassembly, inspection and modification of design. It also has been decided to ship the remaining four transformers to the English Electric plant in St. Catherines, Canada, in relays, for some modification of basic design. It is planned to have three of the reconditioned trans-

formers back in service at Priest Rapids by the end of 1960, and the remaining two back in service by the expiration of the construction contract on September 21, 1961. In the meantime, English Electric proposes to borrow two transformers from an American utility company and use them at Priest Rapids while the original equipment is repaired.

"Some difficulty has been experienced with excessive heat rise in the stators of three of the generating units manufactured in another plant for English Electric. These units will be modified at the dam site to correct the trouble. A fourth generator manufactured at the same plant has not been operated, but will be modified at the dam along the same lines as the other three before being placed in service.

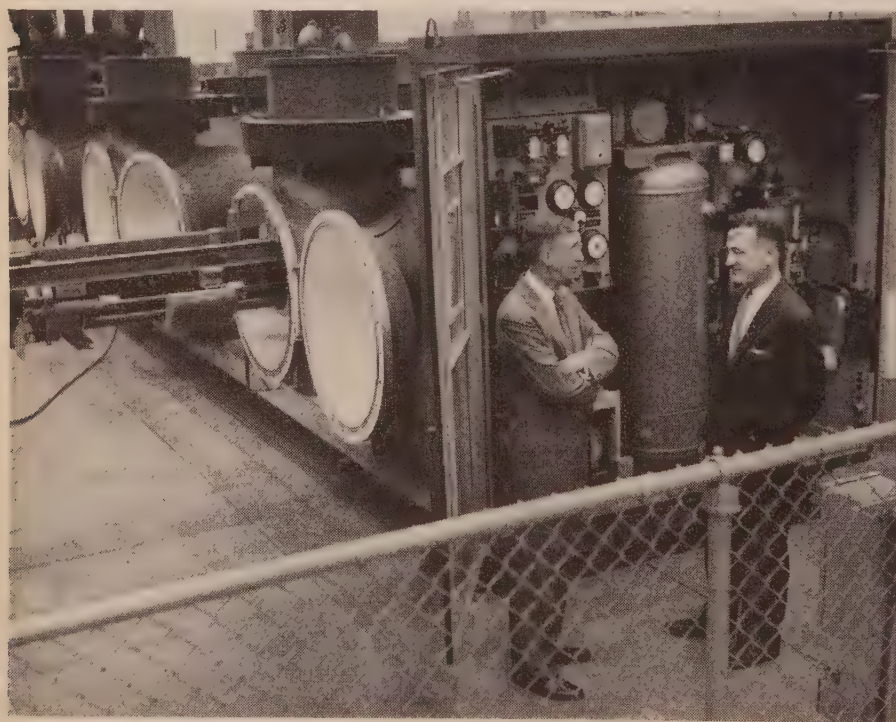
"The six units manufactured in England have met heat requirements, but the air systems will be modified to bring them even further within the limits sought by the Public Utility District of Grant County.

"The construction contract at Priest Rapids runs, through September 21, 1961. The job is well ahead of schedule, but it is expected that these troubles will delay final completion until near the end of the contract period."

An inspection of the generating units at the site set for mid-July, was expected to confirm the cause of difficulties, as indicated above.

Bold Venture—Goal: Better Galvanizing

The day is still rare when a group of manufacturers will collectively admit that the products they turn out *can* be of inferior quality. But, it does happen, as it did last month when one continuing program to improve quality control reached something of a climax in publication of a new "Guidebook: Quality Control of Hot-Dip Galvanizing" by the



First 230 kv, 15,000 mva SF₆ power circuit breaker manufactured by Westinghouse is shown, just prior to shipment to Pennsylvania Power and Light Co. The new breaker, utilizing sulphur hexafluoride gas as the interrupting medium makes possible greater capacity per unit of space than with an oil breaker of the same size. According to the manufacturer, there is no ground shock, nor is there any noise problem. Shown above are (l to r) A. W. Hill, manager, engineering, and J. W. Stirling, manager, both of the Power Circuit Breaker department.

Midwest Job Galvanizers Association. (P. O. Box 72, Chicago, Ill.)

Many electric utility company representatives were in a Detroit gathering called by the MJGA—a one-day technical session timed to coincide with distribution of the guidebook. These heavy users of galvanized products were encouraged to appreciate the importance of quality galvanizing and to demand better quality control from their suppliers.

Readily admitted was the industry's big problem: divided responsibility between steel producer, fabricator and galvanizer . . . permitting flexible interpretation and application of quality control standards. With pertinent ASTM specifications subject to continual but prolonged modification, the expectations for industry-wide quality improvement were conceded to be somewhat limited.

But, the MJGA members—a small group of midwest suppliers who are convinced of their own capabilities in this metal-protective processing field—are pressing for efforts to tighten up the applicable ASTM specs. As ASTM's B. J. Barmack put it, though, "we cannot deal with theoretical defects; to develop specification changes, we need case histories."

So, the MJGA officials emphasized a plea to their user audience to supply specimens of defective (and satisfactory) coatings, along with recorded history of the products, for use in research on possible ASTM specification changes. This work is being carried on by a task force of ASTM sub-committee XIII of A-5, headed by F. C. Brightly, Jr., president of Brightly Galvanized Products, Inc.

Mr. Barmack, chairman of the ASTM A-5 subcommittee and formerly with the Commonwealth Edison Co., warned that the needs for better galvanizing in the power transmission industry would be getting more and more acute, as transmission structures get bigger and bigger with increasingly higher voltages. He applauded the purpose of the MJGA meeting, noting that it was a courageous approach when "for the first time in my experience, a group of manufacturers is showing how their products can be bad."



LOOK—NO FINS!

FOR EASIER INSTALLATION, DELTA-STAR ELIMINATES FINS ON DISTRIBUTION TRANSFORMERS THROUGH 50 KVA

Elimination of cooling fins has made Delta-Star distribution transformers more compact—easier to handle and install. On all sizes through 50 KVA, weights and basic tank dimensions match competitive models. The big difference is that Delta-Star transformers save the bulk created by fins or tubes.

Elimination of cooling fins on Delta-Star transformers follows several years of evaluating the thermal characteristics of the transformers. The Delta-Star design

eliminated excess heat—heat that the tank alone cannot dissipate. With no excess heat, there is no need for the cooling capacity provided by fins or tubes.

Delta-Star Distribution Transformers provide high efficiency and good regulation, as well as ease of installation. For complete information, on these cost-cutting transformers, write to *Delta-Star Electric Division, H. K. Porter Company, Inc., 2437 W. Fulton St., Chicago 12, Ill.*

DELTA-STAR



ELECTRIC DIVISION

H. K. PORTER COMPANY, INC.

PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.



"Haley poles are strong and insect free!"

Haley's

CEDAR POLES and FIR CROSS ARMS

Light in weight and clean. PENTACHLOROPHENOL treated in our modern plant for protection against decay, moisture and insect damage.



TWO strategically located yards:

MINNEAPOLIS,
MINNESOTA

FINDLAY, OHIO

R. G. HALEY & CO.
SPITZER BLDG.
TOLEDO 4, OHIO

Leased Lighting Concept Introduced

A nation-wide leasing plan, whereby modern fluorescent lighting can be installed in new or old buildings on a five year rental or time payment basis has been marketed through an agreement between Smithcraft Corp. and General Electric Credit Corp. The plan, called Smithcraft Lease-Light, permits owners or tenants in the United States and Canada to rent or finance lighting modernization or new construction, while freeing working capital for other uses.

Said Smithcraft Vice President of Marketing, George T. Wood, in announcing the program, "We think this plan will open a substantial new market in the relighting and new construction fields wherever there is a shortage of working capital. Users can now save their capital to reinvest profitably in their business while getting the benefits of the best of modern lighting."

Under the agreement, Smithcraft would sign an agreement directly with the user, permitting him to use his own electrical contractor for installation. Payments by the user would be made to General Electric Credit Corp. Smithcraft would then pay the distributor and the contractor.

According to a Smithcraft official, the total contract price could be as low as \$1,250, with or without installation costs. There is no upper limit.

Under the lease-light plan, Smithcraft's complete line of commercial fixtures and Light and Sound conditioned ceilings are available for as little as $\frac{3}{4}\phi$ per-sq-ft-per-month in factories and stores, one cent per-sq-ft-per-month for schools, and one and one-fourth cents per-sq-ft-per-month for office areas, based on the average cost and recommended lighting levels for these areas.



The benefits of quality high level lighting are now available to even the smallest businesses through the Smithcraft Leased-Light program. Installations such as the above can be financed out of profits over a five-year period, thus preserving working capital levels.

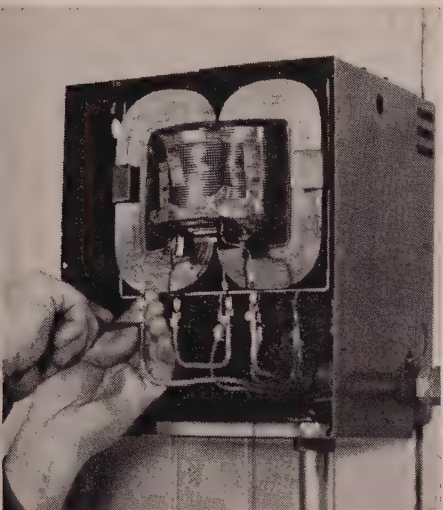
Epoxy Insulated Dry-Type Transformer Introduced

Specifically designed for indoor use a line of general purpose, ventilated, dry-type transformers in rating 3- through 50-kva, single-phase, 600 volts and below, has been introduced by Allis-Chalmers.

The three-piece case has convenient knockout locations to permit standard size conduit to be connected from either side or bottom. Because of its lighter weight
(Continued at top of next page)

and reduced size, the new transformers are especially easy to install.

The core is constructed to give quiet, low loss, low exciting current operation. Coils are wound with high temperature epoxy film insulated wire. Large cooling ducts in the air flow assure long life with more than adequate overload capacity.



The impregnated core and coil unit completely isolated from the case assures quiet operation.

The transformer, shipped completely assembled and ready for installation, is ideal for spot load center applications where critical voltages must be maintained for efficient operation of equipment.

Computer Cuts Transformer Shipping Time

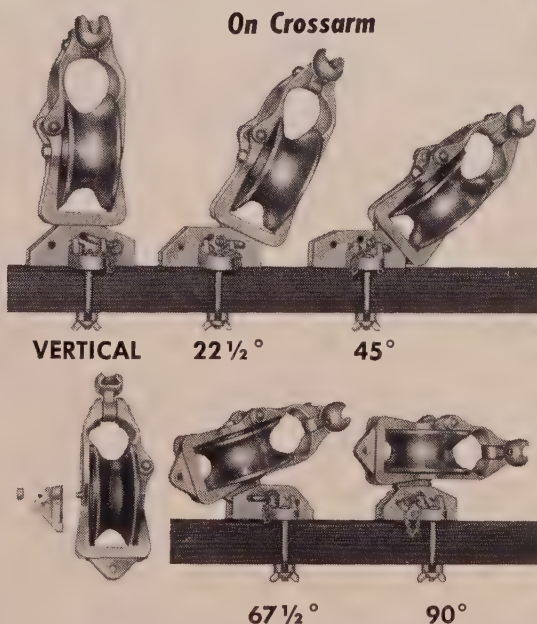
Normal shipment time of General Electric medium transformers has been reduced approximately 20 per cent with the addition of computer designing to existing repetitive manufacturing procedures.

Single-phase and many smaller three-phase units in the 501- to 7,500-kva rating range can now be shipped to utilities and industry in five weeks from the medium transformer department in Rome, Ga. Spokesmen for the company say that no more than six weeks will be needed for even the largest standard design units in the range.

The computer-designed transformers also embody several basic improvements over previous designs. Among these are reductions in height and weight.

"Linemen's dream" ... from any angle!

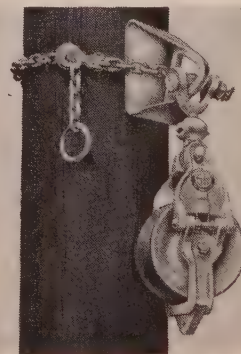
SR **MODEL XS-100**
UNIVERSAL
STRINGING SHEAVE
with adjustable crossarm bracket



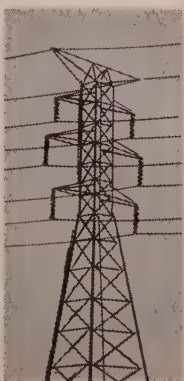
On Crossarm With Added Angle Attachment

67 1/2°-90° Angle Attachment and Pole Bracket are accessories.

In Suspension



With Pole Bracket



SHERMAN & REILLY, INC.

Engineers & Manufacturers

Chattanooga 2, Tennessee • Phone AMherst 7-1273

Mail coupon for complete data

C

Sherman & Reilly, Inc., 1st and Broad Sts., Chattanooga 2, Tenn.
Please send complete catalog of S&R
conductor stringing equipment.

NAME _____ POS. _____

COMPANY _____

ADDRESS _____

KLEIN KORD NYLON SAFETY STRAPS



**WITH
THESE FEATURES**

Klein developed the first fabric safety strap and have pioneered in every development. The recently introduced Klein-Kord Nylon Safety Strap offers these features:

LONGER LIFE—Superior construction, woven from filament nylon. Stretch has been almost eliminated.

PLY ADHESION—The multiple plies of strongly woven pre-dipped nylon are frictionized in neoprene and vulcanized.

FLEXIBILITY—Klein-Kord Nylon Safety Straps are extremely flexible and assure maximum comfort and greater strength. When tested in use, these straps are capable of a test load of 2750 pounds, far in excess of any load they will be called upon to support in service.

QUALITY HARDWARE—All buckles and snaps are drop-forged and tested by Klein in their own forge shop.

**WRITE FOR
BULLETIN 560**

ASK YOUR SUPPLIER

Foreign Distributor:

International Standard Electric Corp., New York



Mathias KLEIN & Sons
Established 1857
INCORPORATED
7200 McCORMICK ROAD, CHICAGO 45, ILL.

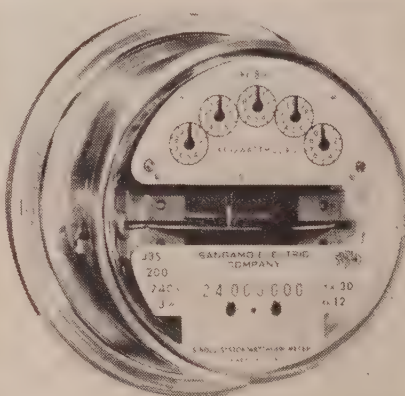
NEW PRODUCT

DESIGN



Watthour Meter Disk Floats on Magnetic Cushion

The Type J3 watthour meter by Sangamo Electric Co. employs a magnetic floating system that supports the moving elements, virtually eliminating friction and wear.



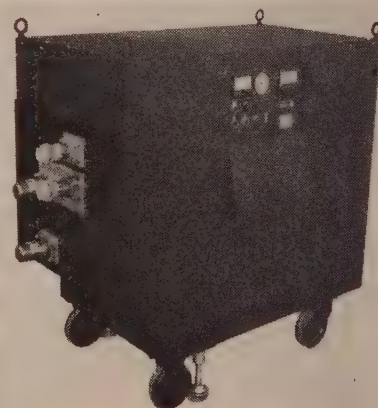
Special Alnico magnets float the rotating element on frictionless lines of magnetic flux. Combined with upper and lower cobenium pivots and graphite rings that guide the element, the "magnetic cushion" holds the disk accurately in position, even when the meter is installed out of line. Current coils are epoxy-coated providing improved insulation and better heat dissipation. The potential coil is encased in acetate to provide 10 kv rms insulation level and a safety factor in respect to the arc-gap flashover value of 4,500 volts. Potential coil characteristics of a 3-wire, 240 v. J3 are such that it can be used on a 2-wire, 120 v. service.

Circle item #30 on reply card

Line Tap Switch

A complete switching scheme for mounting on a single pole—the first such designed specifically for transmission line use—has been developed by Powerdyne Inc. The Line Tap Switch is designed to be an integral part of the line. It eliminates the need for crossarms, suspension insulators, and extra strong poles. Equipped with a quick-break attachment which extends its use to line dropping and transformer magnetizing current interruption.

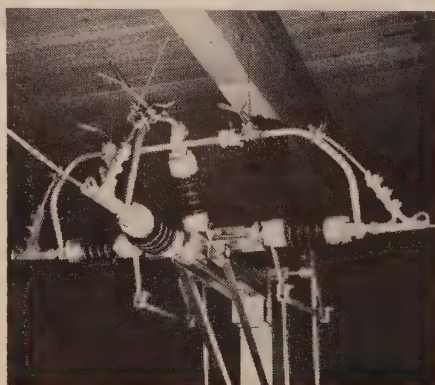
Circle item #31 on reply card



Breaker Test Units

Mobile high current test units for large-capacity, low-voltage power circuit breakers have been developed by Multi-Amp Electronic Corp. Model CB-750 is designed to test series trips on breakers in the 75,000 amp IC class. Unit is rated 75 kva and is designed for operation on 480 v, 60 cycle single phase service. Output terminals have interchangeable stabs that will allow testing all makes of breakers.

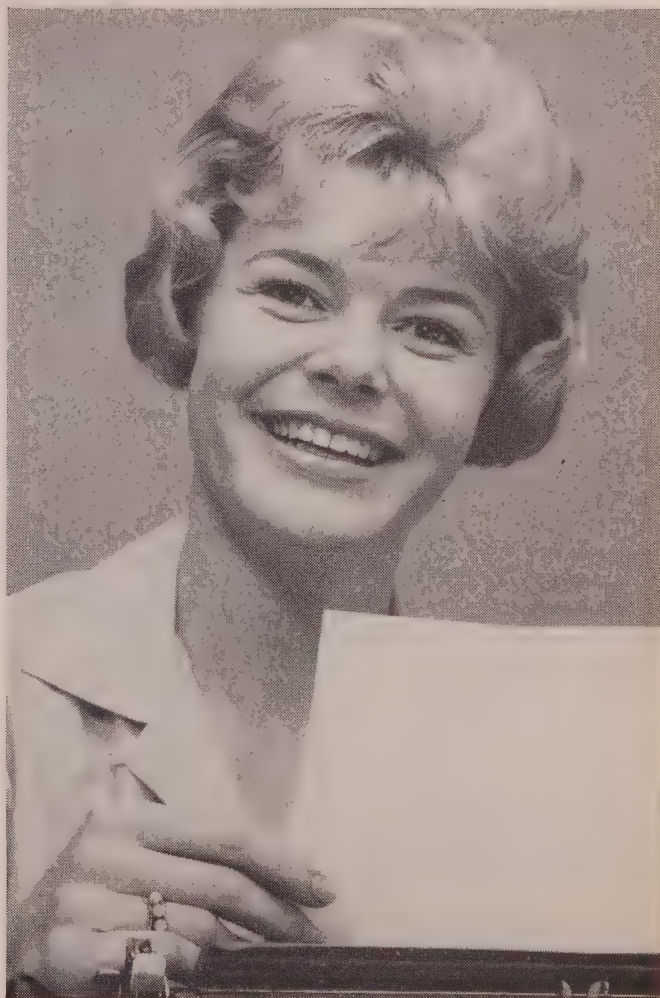
Circle item #32 on reply card



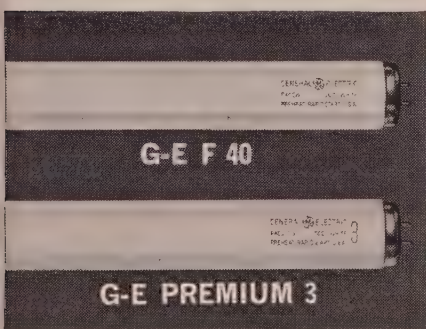
How much brighter would your customers like their secretaries?



20%? You can brighten their secretaries—and all their other people, too, by improving their “eye-Q” (their ability to see better, work better). If the present lamps are 1 to 3 years old, suggest replacing them with General Electric F-40 Fluorescent Lamps tonight. Tomorrow your customers will have 20-35% more light without adding a single new fixture! G-E F-40’s work in present 40-watt fixtures whether they use starters or not, cost 5¢ less than previous rapid start lamps.



50%? It can happen. New G-E Premium 3 Lamps are the most powerful 40-watt fluorescents on the market and the first 40-watters to deliver over 3,000 lumens! Just replace all his 1-to-3 year old lamps with them. The higher lighting level means his people will make fewer errors; efficiency and morale will get a big boost. General Electric Premium 3 Lamps also work with or without starters. They get up to 50% more light without spending a cent on new fixtures.



USE GENERAL ELECTRIC “MONEY SAVER” FLUORESCENT LAMPS TO BRIGHTEN PRODUCTION PEOPLE AND SALES AREAS, TOO

New Premium 3 and F-40 Lamps are two recent examples of how G-E research saves your customers money and gives them more light, too. And at the same time gives you the newest, most effective sales tools to work with. General Electric Co., Large Lamp Dept. C-011, Nela Park, Cleveland 12, Ohio.

Progress Is Our Most Important Product

GENERAL  ELECTRIC

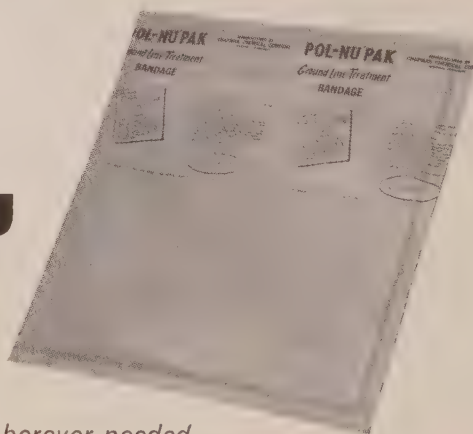
GENERAL ELECTRIC...WHERE BRIGHT IDEAS BECOME BETTER LAMPS

Now line crews can apply ground-line pole preservative



POL-NU PAK

Convenient, envelope-type ground-line treatment bandage for quick application wherever needed

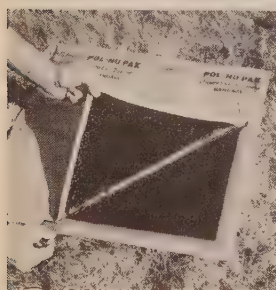


Enlist your line crews in a system-wide effort to get longest service life from standing poles. With Chapman Pol-Nu Paks carried as standard equipment on service trucks, crews can apply ground-line preservative treatments to poles.

This convenient pole preservative bandage comes as a factory-sealed envelope containing Chapman Pol-Nu, the original grease-type pentachlorophenol preservative. Applied as shown in the steps below, it prevents errors and assures adequate Pol-Nu at the ground-line to restore

natural loss of preservative in this critical area, resulting in many years of additional pole life.

Pol-Nu Paks are available in several sizes and, because of their convenience, are sometimes preferred for all ground-line treatment work. However, Chapman Pol-Nu in bulk containers and the Pol-Nu Bandage-Maker for preparing pole bandages in the field offer economies where many poles are to be treated. For information on both methods, using your own crews or contractor-applicators, mail the coupon below.



Slit Pol-Nu Pak on three sides to expose preservative.



Wrap bandage around pole at ground-line and staple.



Back-filling completes job, assuring longer pole life.

CHAPMAN CHEMICAL COMPANY

Leading manufacturer of wood preservatives • Memphis 1, Tenn.
Palo Alto, Cal. • Portland, Ore. • Minneapolis • Charlotte, N. C.

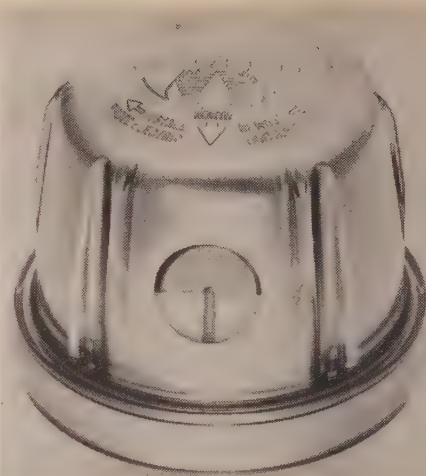


POL-NU PAK

MAIL COUPON FOR COMPLETE DATA

Chapman Chemical Company
P. O. Box 138, Memphis 1, Tenn.
Please send data on Pol-Nu Pak and information on extending pole life to:

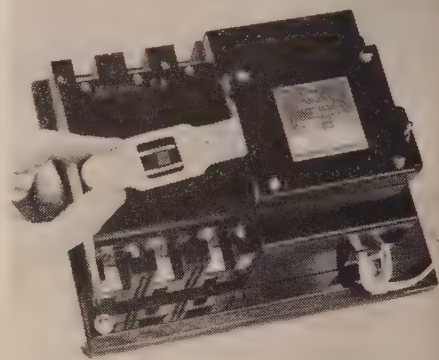
Name _____
Company _____
Address _____



Photoelectric Control

The Lamplighter photoelectric lighting control by Acme Wire Co. has an injection molded plastic cover and base to provide high dielectric strength. Fuse protected against overloading, the unit is further protected against small surges by a rare built-in gas lightning arrester. Light level, adjustable externally from the base, can be set from one to ten ft-candles. Also employs a time delay.

Circle item #33 on reply card



Electrical Operators

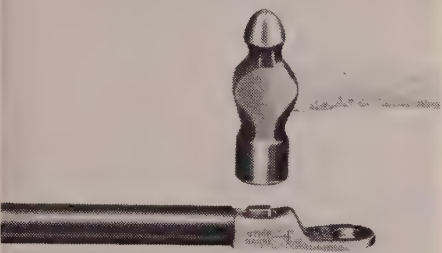
A line of electrical operators that allow Type AB circuit breakers to be remotely controlled is now available from Westinghouse Electric Corp. Models with rated control voltages of 120, 240, 480, or 600 volts a-c and 125 volts d-c can be supplied. They will actuate breakers rated to 100 amps at 600 volts in frame sizes E, EH, and F. Unit does not impair overload protection features of breaker or hinder manual operation.

Circle item #34 on reply card

Lugs and Splicers

A hammer is the only tool necessary to make good connections with Red-E lugs and splicers, eliminating the need for crimpers, wrenches and welding equipment. By **Bernard Welding Equipment Co.**, the connectors also featured easy-to-read cable size markings and handy stripping gauge stamped on each unit. Installation is made by inserting cable, then driving down a self-contained impact punch with an ordinary hammer.

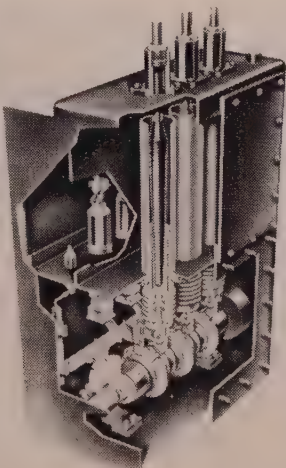
Circle item #35 on reply card



Network Transformer Bushings

Bayonet-type bushings, with a plug-in connector, is now available on **Westinghouse Space-Miser** network transformers as a cable termination for 15 kv and below. The connector may be used with lead, rubber, or other unshielded cables. The new submersible terminal chamber may be used without fluids or compounds as it has adequate insulation strength with air. Rated 400 amp continuous and 15,000 amps for five seconds.

Circle item #36 on reply card



Lumatrol Mark I, Actual Size (NEMA Mounting)

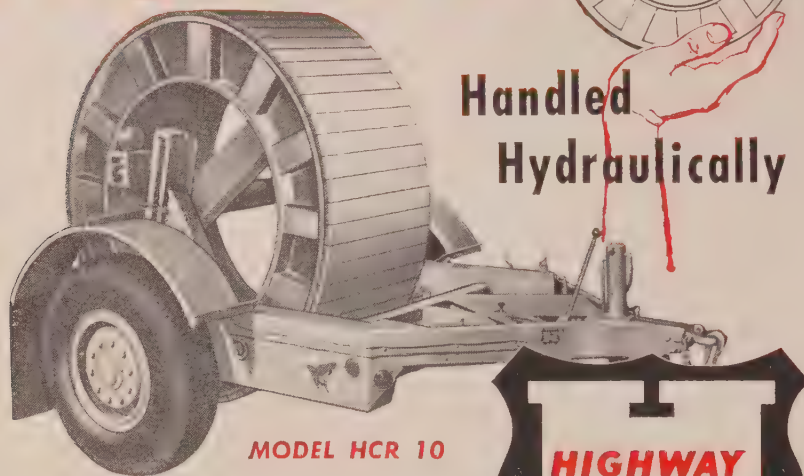
LUMATROL[®] MARK I!

If highest reliability at lowest cost
is your most important requirement in
automatic street light control...
this is the baby that will do the job!

Write for Complete Specifications

MICRO BALANCING, INC., Garden City Park, New York
In Canada: J. R. Kearney Corp., Box 270, Guelph, Ontario

10,000 pounds



MODEL HCR 10

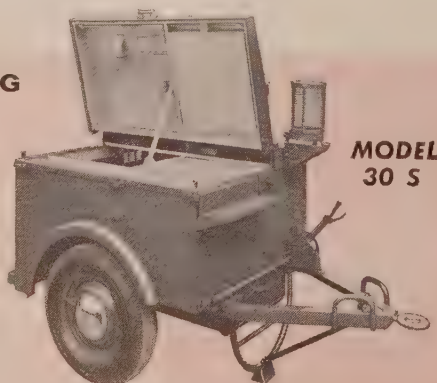
simple one-man operation

... performs difficult work faster and easier with this new heavy-duty cable reel trailer by Highway

- Hydraulic operation of all action
- Designed to handle the largest reels up to 84" in diameter—48" wide and up to 10,000 pounds in weight
- Heavy box construction assures many years of efficient, low-maintenance service
- Double spring suspension (elliptical leaf spring plus coil springs) assures outstanding roadability and off-road operation
- Large-capacity 1100 x 20 tires
- Cab-controlled electric brakes and ICC rear lights

"CABLE SPLICING MADE EASY"

The Model 30-S trailer is an all-steel, compact, complete cable splicer's field workshop. Complete tool and accessory trays and compartments—fire-proof, weatherproof and theft-proof—1400 lbs. capacity. Heavy-duty construction throughout.



MODEL 30 S

For complete information on the new hydraulic heavy-duty cable reel trailer and cable splicer trailer, see your local Highway distributor—or write directly to

UTILITY DIVISION
HIGHWAY TRAILER COMPANY
 HEADQUARTERS: STOUGHTON, WISCONSIN
 Manufacturers of Public Utility Bodies • Earth-Boring Machines • Pole and Cable Reel Trailers • Winches • Power Take-Offs • Service Accessories • Commercial Trailers
 Dry-Bulk Haulers • Cargo Containers — Land, Sea and Air
 SALES AND SERVICE IN PRINCIPAL CITIES



Connectors, Accessories

Bronco-Grip connectors and accessories by **Western Insulated Wire Co.** have high mechanical and electrical durability. Available for either copper or aluminum cable, the types initially offered are split bolt, vise grip, service entrance, various clamps, parallel connectors, aluminum compression sleeves, solderless terminal lugs, ground clamps and straps.

Circle item #37 on reply card



Welded Screw Anchor

A sharp cutting edge on the helix, careful control of the helix angle and keeping the helix perpendicular to the rod, and a chisel point which helps the anchor work its way around obstructions make the **Joslyn Welded Screw Anchor** easy to install. Special manufacturing method results in a tough, ductile weld that is stronger than the base metal. Available in all sizes from 4- to 15-in. diameters, with standard tripeye rod.

Circle item #38 on reply card

Meter and Mount

A universal meter mount that combines current and potential transformers has been announced by Sangamo Electric Co. Combined with the Sangamo P6S universal meter for application flexibility, it may be used for metering all types of service up to 480 volts and loads through 300 amps. Terminal block of the mount is designed so that current transformer secondaries are automatically short-circuited when the meter is removed from the mount.

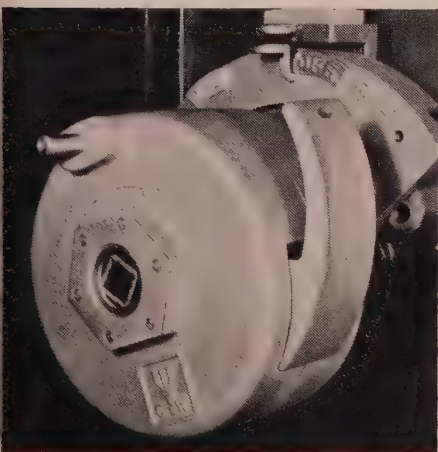
Circle item #39 on reply card



Spring-Operator

G. & W. Electric Specialty Co. has announced a portable spring operator which provides fast, trip-free snap action for positive motion in switching from any position to the next in a new line of Snapact load-break oil switches. Switching action is non-reversible and positive, increasing safety and reducing burning and pitting of contacts. Operators weigh only 25 lbs. Will carry and interrupt 400 amp load current and handle 5-, 7.5-, and 15-kv.

Circle item #40 on reply card



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TOP PHOTO: New White Way—White Plains, New York

LOWER PHOTO: Traffic circle illumination—West Miami Springs, Florida

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More than just modern-looking, P&K street lighting standards are modern in total concept. Compare our use of functional design... no scrolls, no tie rods... instead a strong aluminum tapered elliptical arm—one piece for minimum inventory, fastest assembly and installation. Compare the P&K davit, truly the ultimate in functional design with a style as fresh as tomorrow. What's more, P&K is modern in the materials of construction: to the inherent strength and light weight of aluminum, P&K has engineered designs to meet every load requirement—from the conventional incandescent and mercury vapor luminaires to the new, larger and heavier models in both mercury vapor and fluorescent. And above all, P&K is modern in its elimination of maintenance problems. No painting required—ever. Even the salty sea air offers no hazard to the good looks of P&K standards.

For more information reserve your copy of the new Aluminum Lighting Standards catalog now. Ask for our helpful brochures ALS and BR-11.

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Repair damaged conductors

TAP ARMOR ...

Protects conductor at
tapping points

FANNGRIPS ...

For dead-ending strands
and conductors

FANNSPLICES ...

Join two ends of conductor
wire

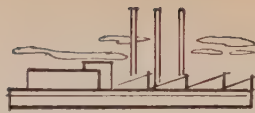
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For conductor surface
protection

FANNER

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Brookside Park—Cleveland 9, Ohio
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SUPPLY



FACILITIES

Production Briefs

Plans for an addition of a \$2-million capacitor foil rolling mill plant to the capacitor manufacturing facilities located in Ft. Edward, N. Y. have been announced by **General Electric**. The installation will consist of a 3-stage rolling mill for producing capacitor grade aluminum foil from "reroll" stock, annealing furnaces, slitters, and a roll grinder, together with auxiliary equipment for handling and storing the materials.

Improved conduit performance and reduced handling and installation costs are the prime advantages offered in a new line of rigid aluminum conduit being manufactured by **Harvey Aluminum**. Exclusive features include 90 degree elbows with maintenance of cross-sectional shape in the bend area and full interchangeability with steel elbows.

Miracle Adhesives Corp. has announced that they have recently completed arrangements under which **Hitemp Wires, Inc.** will make and sell Miracle's Zip-on Tubing for wire and cable coverings. The only other licensees of Miracle are Zippertubing Co., Los Angeles, and Alpha Wire Corp., which is currently being sued by Miracle for unpaid royalties.

IBM has announced a new service to help their customers get their computers "on the air" faster at reduced costs. A wide range of pre-tested computer programs, each designed to handle a major data processing function common to all firms within a given industry, will be made available through the company's new Programmed Applications Library. Currently available from the library is a utility customer billing and accounting program for the solid state IBM 7070 data processing system. Other programs will be announced in the near future.

Sales Briefs

Service & Supply Co., Appleton, Wisc., has been named a distributor for **Arvin Industries, Inc.**, primary electric heat systems. The distributor serves 22 central and northern Wisconsin counties.

S & C Electric Co. has appointed **Roy E. Wilson Co.**, Atlanta, Ga., representatives for the company's high-voltage switchgear. The Wilson Co. will service the entire state of Georgia.

Six new representatives have been appointed by **Powerdyne, Inc.**, manufacturer of pole top switches. They are: **Associated Engineers**, El Paso, Tex.; **Burr T. Carmody**, Chicago, Ill.; **Henry Geo. Lehl**, Oswego, Ore.; **Matzinger-Johnson Co.**, Los Angeles, Calif.; **Pickney and Hine Co.**, Minneapolis, Minn.; and **Wrathall-Krusi Inc.**, San Francisco, Calif.

Davies Laboratories Division of Minneapolis-Honeywell Regulator Co. has changed its name to Honeywell Industrial Systems Division.

A new plant, scheduled for completion in October, will double both the production space and production capacity of **Precision Transformer Corp.** The new facility is being constructed in Elk Grove Village, Ill.

H. R. Gilbert Co., New Orleans, La., has been named sales representatives for the **Hayes Corp.**, Michigan City, Ind., manufacturers of instruments and controls for the power industry.

The newly formed firm of **John L. Marsh & Associates**, Jacksonville, Fla., has been named representatives for **Tele-Wire Supply Co.**, and **Walter G. Pearson Co.** for Florida, Alabama, and Georgia. The Florida firm also represents **Ansonia Wire and Cable** and **Hendrix Wire and Cable**.

System Application . . .

(Continued from page 66)



step-up transformer is 18 mvar; with this station out of service we can expect this much drop in gross total mvar.

Many technical papers have endeavored to show that power factors well up into the nineties are justified on distribution circuits to release capacity, reduce losses, and improve voltage regulation. It is also important that high voltage transmission lines operate at high power factors. Capacitors installed on the distribution system to generate vars near the load requiring them, and switched on and off in cycle with changing load requirements, will provide high power factor load on the transmission system and result in good voltage regulation under normal conditions. It will also provide a high power factor on generators under normal conditions. Then, under emergency conditions with one machine down, remaining generators will have capacity to pick up var generation of the machine in trouble and also provide var requirements of the tie-line bringing in the watts.

BIBLIOGRAPHY

Circle Diagrams. Electrical Transmission and Distribution Reference Book 1950. Page 273-6.

Capacitor Switching Methods. Transmission and Distribution Magazine. February 1960. Page 10.

Locating Capacitors on Distribution Feeders. Distribution Magazine (G. E. Co.) January 1960. Page 10.

. . . TO THE EDITOR

Dear Mr. Garrett:

I agree that the type of material contained in your May 15th editorial should be publicized as extensively as possible. Therefore, it is my intention to use it in the July issue of *P. G. and E. Progress*. It is my plan to use this sort of material on a continuing basis, but certainly during the months preceding the November election.

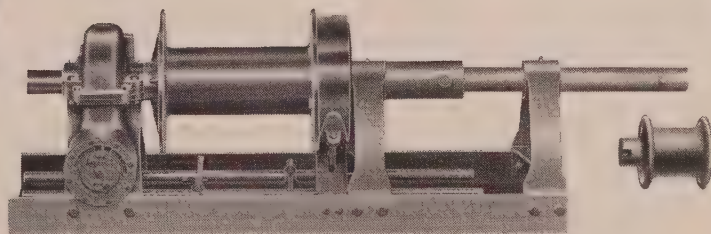
You may be interested to know that our customer-stockholder magazine is now mailed to 3,330,000 homes each month.

Lawrence R. McDonnell
Editor, *P. G. and E. Progress*
Pacific Gas and Electric Company

(Editor's note—*P. G. and E. Progress* is mailed to every state in the Union and most countries throughout the world. It reaches more than 2.3-million California readers monthly, virtually every domestic and small commercial customer in
(Continued on page 106)

SPECIALIZED TULSA® WINCHES FOR

PUBLIC



UTILITIES

Tulsa Utility winches are furnished with extended shaft and optional bayonet niggerhead. Safety factors are higher than S.A.E. specifications.

Gear box cover is removable from the top for easy inspection or dis-assembly when necessary, without removing utility body. Winch is manufactured of the finest materials and expert workmanship. Sizes and models for all applications.

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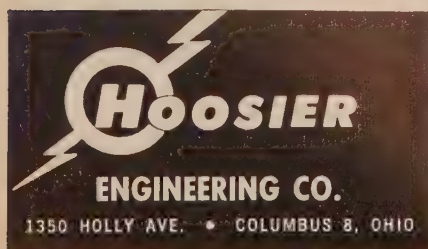
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the northern and central regions of the state.)

Dear Mr. Garrett:

Your message on the beat-Russia phobia that seems to be developing in some quarters of this country is certainly very timely. It isn't too difficult to imagine what would happen to people in the Soviet who spoke against their own country as some are doing here. Even if some of the things these critics are saying were true—which in most cases simply are not true—these attacks should not be made public in a way that brings solace to the Russians and embarrassment to the United States. In Russia, these same attacks would probably be considered treasonous.

In recent months we have undertaken several projects which we hope, in a small way at least, may contribute to the feeling that the U. S. is far from second rate yet. We have published summarized versions of Mr. Sporn's report on electric power in Russia in our supervisory and all-employee publications. We have made the EEI report on Russian and American power available to employees in all locations and summarized it in our supervisory publication. In addition, our public information department made the report available to all newspapers in our territory and several fine stories and editorials resulted.

Perhaps we can continue along the same lines by reproducing your "Light and Power Lines" page in our supervisory publication. May we have permission to copy it for that purpose and perhaps to quote from it in our all-employee magazine?

T. G. Christofferson
Publications Editor

Wisconsin Public Service
Corporation

Dear Mr. Garrett:

This is in reference to your editorial in the May 15 issue of *ELECTRIC LIGHT AND POWER*. I'm sure it will serve to allay anyone's fears about our country's strength.

I wish, however, that Mr. Harlow (and others who quote the same statistics about our material might)

would have gone on to explain that our superior productive capacity is the direct result of hard work and individual capital investment within our system of free competitive enterprise, and that our productive pre-eminence would be even greater if it were not for governmental hamstringing of private enterprise and capital growth, and bureaucratic nurturing of socialistic schemes and practices.

I believe the majority of Americans already know that we have more bathtubs, telephones, electric power, paved roads, TV sets, bars of soap, comic books, automobiles, etc., than the rest of the world combined. What we apparently do not understand is that these are the products of free enterprise, and that we'll have them only so long as we are willing to work for them, and that right now we are allowing our productive strength to be weakened by politically expedient whispers of assurance that we can have it all by letting the government give it to us.

Somehow, I seriously doubt that disparagement of our country's strength represents a widespread point of view. Many of those who hammer away at this theme appear to me to be, on the record of their own history, those who seek further concentration of power in our national government, and use the Russia-catching-up argument as an effective screen behind which to achieve that objective. At least, when they wail about Russia closing the productive gap (which, as you observe, is a misrepresentation of the facts—in short, a lie), the solution they offer is more government control, more taxes, more "planned" economics, which would further weaken the very system through which we have achieved productive superiority in the world.

If Russia is closing the gap, the reason is our failure to protect our own freedoms right here at home, our senseless acceptance of more and more government, which leads to less and less productivity and prosperity.

William B. Dyke
Publications Supervisor

San Diego Gas & Electric
Company

Dear Mr. Garrett:

Heartiest congratulations to you and the staff of **ELECTRIC LIGHT AND POWER** for having received a National Safety Council's 1959 Public Interest Award. This recognition is entirely deserved, for you have long advocated that the Electric Public Utility Industry vigorously support a practical program for preventing both employee and non-employee injuries.

Your encouraging support of such a program is bearing fruit. A careful study of the safety-conscious illustrations appearing in your publication will, alone, prove the point. Your April 15, 1960, editorial was the frosting on the cake.

Arthur J. Naquin
Chairman

Edison Electric Institute
Accident Prevention Committee

Dear Mr. Garrett:

Your editorial on the superiority of our production system over that in Russia was well received. Bryce N. Harlow, deputy assistant to President Eisenhower, uses a novel means of showing how we could "enjoy" the Soviet scheme of things by junking most of what we have now.

I would like to quote from the piece you wrote, using excerpts in future issues of our employee newspaper, *The Outlet*.

Owen E. Grinde
Editor, *The Outlet*

The Montana Power Company

Dear Editor:

Just a note to express our appreciation of the very excellent coverage, received in your May 15th issue, for the recent Conference of our Administrative Services Section. We are gratified that you found the discussions worthy of such extensive recognition.

Victor W. Hartley
Managing Director

Pacific Coast
Electrical Association, Inc.

Dear Mr. Garrett:

Your May 15 editorial does an outstanding service to the country. I certainly agree that we must nul-

lify the propaganda efforts of those who say we are becoming a second-rate nation, and particularly the fact that we must adopt even more socialistic, big-government measures to stay ahead of Russia.

James S. Turner
Editor, *Plain Talks*

Gulf States Utilities Company

Dear Mr. Garrett,

EL&P certainly gave poor little Potomac Edison Company short drift in the April 1 edition . . . twice, in fact.

On page 7, you called us Potomac Electric . . .

On page 84, you listed our Mr. Sanders and Mr. Geoghegan, but failed to mention the company at all . . .

Phil O'Connell
Advertising Manager

The Potomac Edison Company

Sincerest apologies to Potomac Edison for our failures in the April 1 issue. We stand corrected.

Dear Mr. Garrett:

We read with interest the article "REA—25 Years Old Now" (EL&P May 15), wherein, under the heading "REA Loans to Private Power Companies" you state:

"Private power companies are still eligible for REA loans. They must show, however, that it would not be economically feasible, under available private financing terms, to build the facilities proposed for extending service to rural customers."

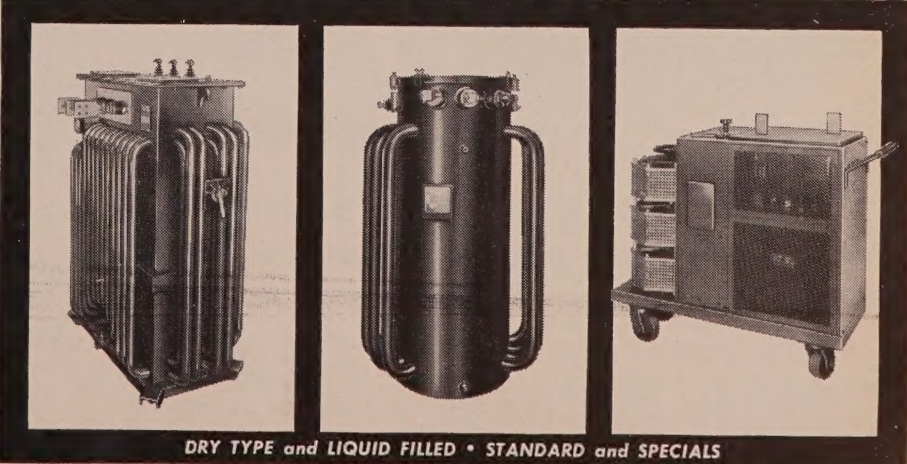
We would like to point out that no such showing has ever been necessary . . . and no such showing is necessary today. An applicant does not have to prove that the project would be feasible with private financing. It should also be noted that REA loans have been approved to such large utilities as Arkansas Power & Light Co., Florida Power Corp., Georgia Power & Light Co. and Public Service Co. of Indiana, Inc.

Ralph J. Foreman
Deputy Administrator
Rural Electrification Admin.



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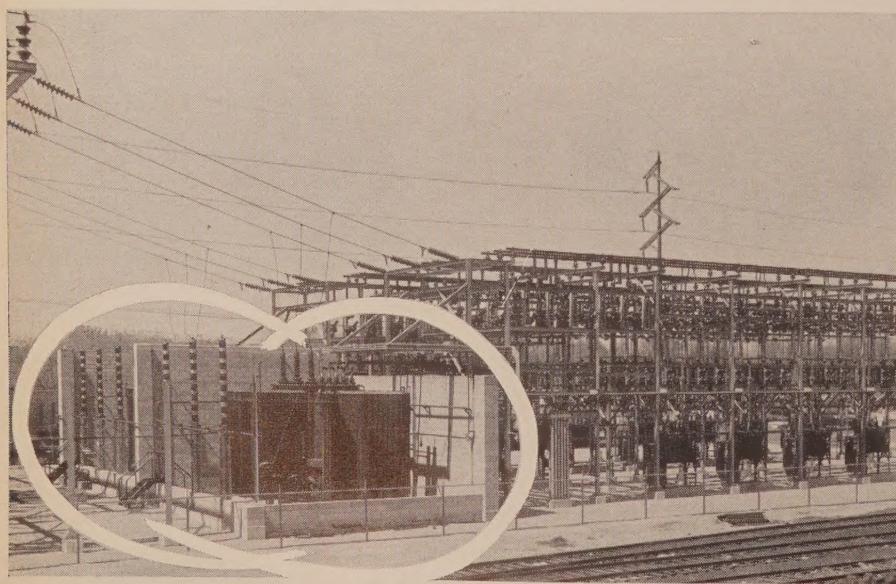
Paul O. Canaday has been elected president of Arkansas Power and Light Co. He has been executive vice president since 1958. He succeeds Robert E. Ritchie who continues as chairman of the board of directors and of the executive committee.

At the same time Reeves Ritchie, son of the chairman, was elected a vice president. He continues as the company's personnel director.

Mr. Canaday, a 1926 graduate of the University of Tennessee, came to Arkansas P&L from Middle South Utilities, parent company of the Arkansas utility, in 1958. He served with Tennessee Public Service from 1926 to 1938, when he joined Ebasco Services. He served as treasurer, then as vice president



of Electric Power and Light from 1944, then became vice president of its successor, Middle South Utilities, in 1949.



A DELTA GROUNDED TRANSFORMER

will usually **SAVE SPACE AND MONEY**
when a grounding transformer is required.

Descriptive matter and list of manufacturers licensed under U. S. Patent No. 2,488,628 and Canadian Patent No. 479,050 will be sent on request.

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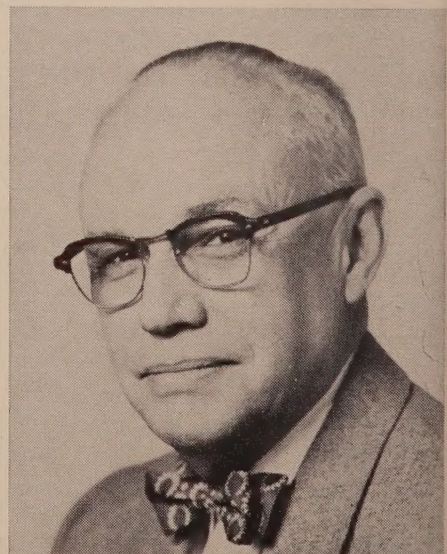
Good Appointed V. P. of Panellit Service Corp.



Louis G. Good has been appointed vice president of Panellit Service Corp., systems engineering firm providing instrumentation engineering, construction and contract maintenance to the utility industry.

His new responsibility will include the complete technical and business supervision of the firms instrumentation and control engineering organization.

A graduate of Virginia Polytechnic Institute, Mr. Good joined PSC in 1953 after experience with the Celanese Corp. of America, North Carolina Pulp Co., and the U. S. Army Corps of Engineers.

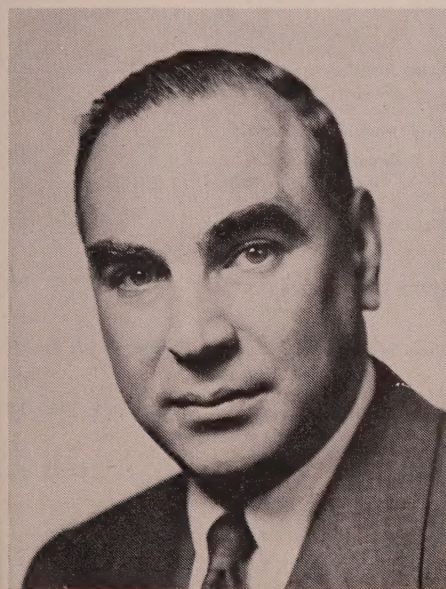


Harry I. Miller, vice president of division operations, Wisconsin Public Service Corp., has been elected president of the Wisconsin Utilities Association. Mr. Miller succeeds Stuart V. Willson. Others elected include: Martin E. Juhl, Lake Superior District Power Co., vice president; Lester M. La Porte, Wisconsin Electric Power Co., treasurer.

Rogoff Elected Burndy Executive Vice President

Julian Rogoff, vice president and manager of the Omaton division of Burndy Corp., has been elected vice president of the corporation. A 30-year veteran of the organization, he has been a member of the Board since 1947.

Mr. Rogoff was elected a vice president in 1955 and has headed the Omaton division since 1956, when it was organized to serve the electronic and electrical manufacturing markets.



Named to succeed Mr. Rogoff as manager of the Omaton division was Fred Heller, former assistant manager. He has held a number of executive engineering positions with Burndy since joining the firm in 1948, most recently as engineering manager and then production manager of the Utility-Industrial division.

Bovier Elected Penelec V.P.

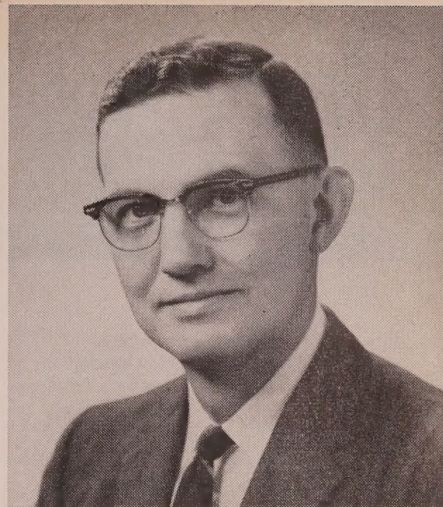
Ralph F. Bovier has been elected vice president in charge of the technical department of the Pennsylvania Electric Co. In his new position, he will have over-all supervision of the generation, transmission, and distribution operations of the company.

Assistant to the vice president-technical for the past year, Mr. Bovier began his utility career with the Northern Pennsylvania Power Co. in 1932.

Lewis Named V. P.

Floyd W. Lewis, formerly assistant to the president and executive counsel, has been elected vice president of New Orleans Public Service, Inc.

He joined Public Service's legal department in 1949 and was named office attorney in 1951. He was appointed executive counsel in 1955 and assistant to the president in May, 1959.



Robert W. McKinnon has joined the staff of the Southeastern Electric Exchange as assistant director. He is the former executive secretary of the Public Utilities Association of the Virginias.

NSP Elects Furber

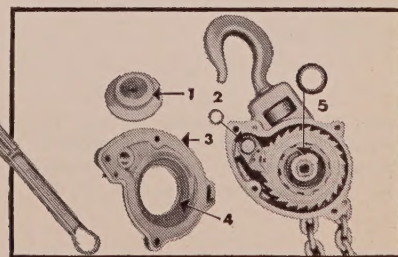
J. Roscoe Furber has been elected vice president of Northern States Power Co. He succeeds the late E. K. Thorgaard.

Mr. Furber, who has been general sales manager for the past 12 years, has been with the company since 1936. He worked as a sales engineer until being made manager of the company's municipal and resale section in 1942, a post he held until his promotion to general sales manager.

Both an engineer and a lawyer, Mr. Furber has long been active in industry activities. He is currently chairman of the Residential Wiring Promotion committee of EEI, as well as serving on a number of other committees.



New Sealed Aluminum Hoist Line means easy lifting in any weather!



Efficient hoist performance is assured by sealing out moisture, oils, chemicals and dirt from the brake mechanism. Five seals provide permanent protection under exposure conditions.

Lifting is easy with the Coffing Sealed Disk Brake Lever Hoist because the handle pull to lift rated load requires only 57 pounds with the $\frac{3}{4}$ -ton model to 93 pounds with the 6-ton model. Load spotting is precise—to within minute fractions of an inch. Sealed brake will not slip. Six models— $\frac{3}{4}$ to 6-tons.

The high strength aluminum alloy frame is light—makes for easy portability. Ask your distributor or write for Bulletin ADH-78.

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CALENDAR OF EVENTS

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August 9-12—American Institute of Electrical Engineers, Pacific General Meeting, El Cortez Hotel, San Diego, Calif.

September 7-9—Northwest Electric Light and Power Association, Annual Convention, Glacier Park Lodge, Glacier National Park, Mont.

September 7-9—American Society of Mechanical Engineers, Joint Automatic Control Conference, Massachusetts Institute of Technology, Cambridge, Mass.

September 15-16—American Society of Mechanical Engineers, Engineering Management Conference, Morrison Hotel, Chicago, Ill.

September 21-23—Inter-Industry Farm Electric Utilization Council, National Electric Farm Power Conference, Hotel Louisville, Louisville, Ky.

September 26-30—Instrument Society of America, Fall Instrument-Automation Conference and 15th Annual Meeting, New York Coliseum, New York, N. Y.

September 28-30—Indiana Electric Association, 51st Annual Convention, French Lick-Sheraton Hotel, French Lick, Ind.

September 29-30—Electric Companies Public Information Program, 1960 PIP Workshop Conference, Sheraton-Charles Hotel, New Orleans, La.

September 29-30—Southeastern Electric Exchange, Accounting Conference, Tides Hotel, St. Petersburg, Fla.

October 5-7—Wisconsin Utilities Association, Electric and Gas Sales and Operating Sections Convention, Schroeder Hotel, Milwaukee, Wisc.

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